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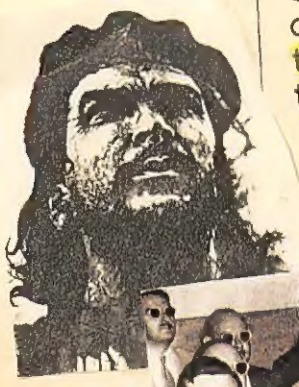

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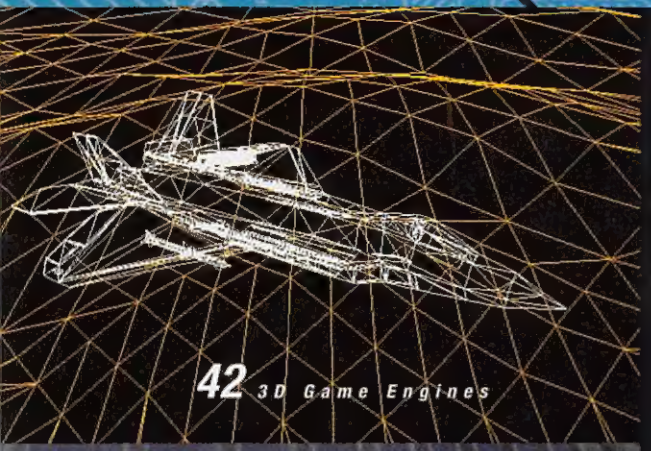

42 3D Game Engines

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Gary Johnson

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3D games are immersive realities the impact of which is directly linked to how effectively a small cadre of coders do their jobs. Jostling for play are technologies such as MMX, 3D acceleration, digital elevation models, micro texturing, portals, and binary space partitioning. Learn how these make up the games we all love.

Best Consumer Digital Camera

(MacUser EddyAwards, Jan.'97)

Product of the Year

(InfoWorld, Jan.'97)

Stellar

(Windows Sources, Jan.'97)

★★★★

(ComputerLife, Feb.'97)

Any questions?

Plenty. How many pictures does the D-200L take?
Up to 80.

You're not sure?
You can shoot in both high-resolution or standard formats. And switch back and forth whenever you want. Even delete the shots you don't want at any time.

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InfoWorld, for one: "The image quality far surpassed any of the other digital cameras." And *Windows Sources*: "It delivers the best images we've seen from a consumer-level camera."

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That's it.

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june 1997

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EDWORD

Beyond the envelope

It was just last Saturday. Software editor Sean Downey and myself were the only ones in the mighty Imagine Publishing complex.

It was dark and quiet next door in the hallowed halls of *PC Gamer*, and the console game mags were still as a church. We'd been madly writing and editing material for the magazine you now hold in your hands, when, come lunch time, we were desperately looking for a distraction. That distraction came in the form of an innocent brown box from Cambridge SoundWorks.

Inside was the PSW1 subwoofer. This sleek, black, $700 monster (reviewed in this issue on page 104) is the size of an end table with a 12-inch long-throw acoustic suspension woofer. We dragged it over to Sean's machine and hooked it up, tuned the Cambridge MicroWorks subwoofer currently running to act as a faux mid-range, and proceeded to crank the PSW1's 140 watts of kidney-stone-busting sounds through tracks of White Zombie, Public Enemy, Ministry, some Jungle compilations—anything we could get our hands on.

> Just as a modern jetfighter can generate the Gs to reduce its pilot to marmalade, we've reached the point where PC technology can exceed the human component.

An hour later, we'd settled down with a Dave Brubek album (which sounded remarkably akin to trip hop with the manic, throbbing bass line). Our stomachs were churning, our heads ached, and our legs were wobbly. We were like small children who'd gorged themselves on Halloween candy. We were sick from too much of a good thing.

After joking about blood in our urine, the obvious occurred to me... Tucked under a person's desktop, the PSW1 is too much.

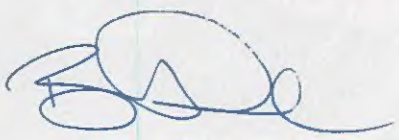
Sure, it makes a round of *Pod* feel as good as it looks. And forget force-feedback joysticks. Running into a wall at full-throttle is a full-body experience with the PSW1 and the concussive force of grenades in *Quake* is tangible.

But just as a modern jetfighter can generate the Gs to reduce its pilot to marmalade, we've reached the point where PC technology can exceed the human component.

Years ago, when I was hot and heavy into digital prepress, talk turned from 24-bit video cards to 32-bit and beyond. Nevermind that this investment only goes toward millions more colors than the human eye will ever be able to discern. "But I need to spec my colors precisely." Yeah. And have you ever seen the way a web press sloshes ink on paper? Tres analog.

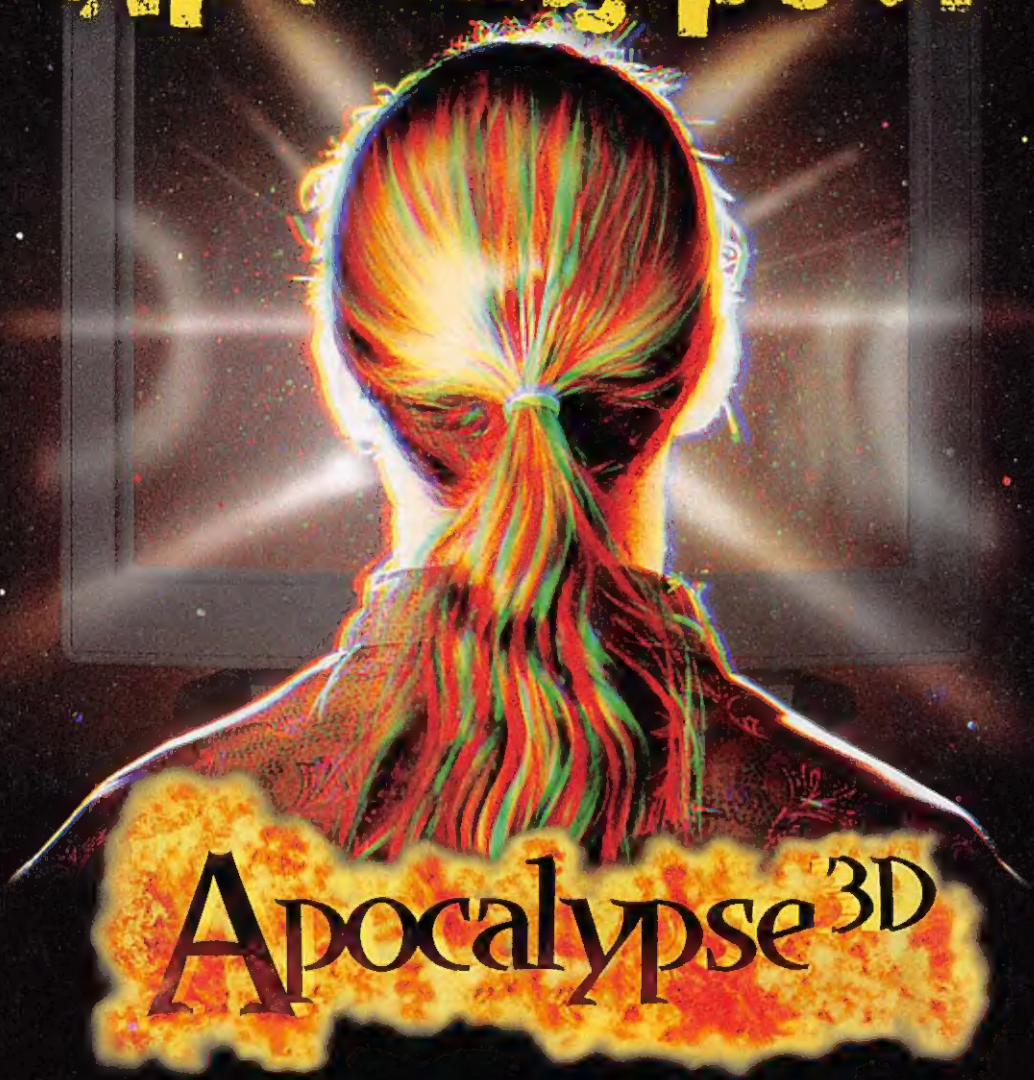
Another example can be heard in the spiel certain 3D-card manufacturers pitch to us about frame rates vs. filtering. In their never-ending denial of the importance of filtering, and relentless pursuit of triple-digit frame rates, they overestimate both the human eye's ability to refresh an image and the CRT monitor's ability to do likewise. What's the point of 90fps if you're only refreshing the screen 75 times a second? And with the eye burn I've logged, my eyes are lucky to make out 30fps.

Ultimately, it's just like an older woman patiently explained to me when I was a freshman in high school, "It ain't what you've got, it's how you use it."



Brad Dosland
Editor in Chief, boot

Are you ready for the Apocalypse?



"This card most certainly rocks."
–Boot, April '97

"...Apocalypse 3D is the most powerful, affordable and down-right desirable 3D games technology..."
–CGW, Jan '97(UK)

"The VideoLogic Apocalypse 3D will revolutionize your games playing."
–PC Answers, Jan '97

"Apocalypse 3D from VideoLogic really sets the standard."
–PC Advisor, Feb '97

"An awesome card."
–PC Home, Jan '97

"Apocalypse 3D delivers incredible 3D performance."
–Boot, Mar '97

"★★★★★"
–Computer Life, Mar '97(UK)

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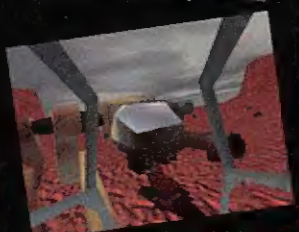

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LETTERS TO THE EDITORS

COUNTER SHOCK

Shel Kimen's comments regarding Shockwave (On the Line, *boot* 07) have led me to believe that she has some sort of brain disorder. She writes, "And although Shockwave has a strong user base that's passionate about animation, truth be known, other products do interactivity better, with less tow on the bandwidth." Only a technical moron would make this comment.

Shockwave is the most viable way to bring interactivity to the web. Its compression capabilities blow anything else out of the water—except for Future Splash, which Macromedia now owns. To count out Shockwave as the number-one multimedia instrument on the web is to openly admit that you are as much of an idiot as Shel Kimen is.

Marco Belmonte

"I understand that Service Pack 2 will let me use NT to play games, but I have also heard that it's chock full of bugs."

AND IT'S FREE, TOO

In the Comm Port letter "bootOS" from Jason Dillon (*boot* 07), I'd like to reply with a little suggestion. There's no need to invent a 64-bit OS, because one already exists. It's called LINUX, and it runs on a DEC Alpha motherboad with peripherals on a 64-bit PCI bus.

Klon Shugart

DIRECTDRAW: HUH?

I love your magazine! Top of the heap, and my subscription check should get to you anytime. I have but one request, please give us the lowdown on DirectDraw. Tell us which DirectDraw cards are bootWorthy. We all know and want Direct3D/OpenGL, but the problem is that most Win95 games are written for DirectDraw (*MechWarrior II, Hind, SimCopter* are all DirectDraw) . To the best of my knowledge, even with a 2D/3D combo, the DirectDraw is handled by the 2D side. So, please, for me, for gamers, for humanity—give us the 411!

John Turner

Technical editor Chris Dunphy replies: *DirectX is a collection of APIs from Microsoft that allows Windows applications to get low-level, fast access directly to the hardware. Direct3D is the 3D side of DirectX, and DirectDraw is the 2D side.*

Games performance under Windows is dependent upon good DirectDraw support, but fortunately most recent graphics cards have plenty of 2D speed to handle just about any non-3D game. Make sure that you have the latest drivers for your card, and you should be fine. To check your DirectDraw and overall gaming performance try running the MDK *PerfTest. This test is now a standard part of our* bootMarks *benchmarking suite. Find out all about our new benchmarks in the 12 Step Program on page 48.*

SWAPPING HOTTIES

On page 91 of *boot* 08, you dissect a Hitachi Mx-133T and do a fine job of it. In your caveat emptor sidebar, you write "...The floppy drive is not hot swappable." Please explain.

Also, I sell Hitachi notebooks and I've noticed that they have a sliding thumb panel to release the floppy unit in the right drive bay. I used to think that a CD-ROM drive could fit into the vacancy, but a regular disc would be wider than the opening. What the heck else would fit into this opening (on the 205CDS model in particular)? Does Hitachi make a proprietary drive that fits into this and plays the little bitty three-inch discs?

Lee Williams

News editor Bryan Del Rizzo replies: *If a device is "hot swappable," it means you can plug it in (or unplug it) while your PC is on; that is, you don't have to re-boot your machine. USB devices, for example, are hot-swappable, but the Hitachi floppy drive is not.*

On the Mx-133T, the floppy drive and CD-ROM drive are interchangable, but unless the manufacturer uses the same formfactor and industrial design, you can't use, for instance, a Gateway 2000 floppy in the Hitachi notebook anyway. The Toshiba Satellite 205CDS notebook features a versatile SelectBay modular option slot that lets you switch between a CD-ROM drive and the floppy drive. If the CD-ROM is installed in SelectBay, you can still use the floppy drive externally or via a port replicator.

WHY NOT PCI?

Why don't we see PCI modems? Wouldn't they reduce stress on the CPU? It's not like PCI isn't as popular as ISA. I mean how many people go out and buy 56.6Kbps modems for their 386 or early 486 computers? Could it be more expensive to make PCI products?

Stephen Herbert Jr.

Technical editor Chris Dunphy replies: *Even an ISDN modem moves data at such an incredibly slow speed compared to the ISA bus that very little would be gained by moving to PCI—except for ease of installation and no damn IRQ conflicts.*

Truth is, a PCI card costs a few dollars more to make, and more systems have free ISA slots than PCI slots—so, for now, modem makers are chasing the dollars with no good reason to switch. But Microsoft has made the elimination of the ISA bus a goal for PCs in '98, so the change will be coming. Though you will likely see modems move from ISA to USB rather than to PCI. Why waste a fast PCI slot for something so slow?

OVERCLOCKING FOR GAMEPLAY

I successfully overclocked my 166MHz to a 180MHz but the bus clock lowered to 60MHz. For graphics-intensive games such as *Quake* and the up-coming *Jedi Knight*, is bus speed more important than processor speed?

Josh Raymond

Technical Editor Chris Dunphy replies: *For general use, the performance of a 180Hz CPU on a 60MHz bus is hardly any faster (and is sometimes slower!) than a 166MHz CPU on a 66MHz bus. And since the PCI bus runs at half the speed of the system bus, your system is now speaking PCI at only 30MHz, slowing down all your peripherals.*

If your motherboard, memory, and peripherals can handle it, you would be better off clocking your system bus to 83MHz and leaving your CPU on a 2x multiplier at 166MHz. If you can get it to work, your system should fly with this setup.

But beware, pushing the system bus to 83MHz is the most extreme form of overclocking you can attempt, and not only are your risking frying your CPU, but also your RAM, motherboard chipset, and PCI cards. So be careful!

WHAT'S A FEW SECONDS BETWEEN FRIENDS?

boot's a great magazine when it comes to deciding what's the best bang for the buck. But I noticed that in your Head-to-Head comparison of the Barracuda 4LP and the Tomahawk 9 that the average seek time for both is eight seconds. Eight milliseconds would be the right number.

Jonathan Estey

GAMING ON NT

I'm currently dual-booting both Win95 and Windows NT 4.0. I would like to get rid of Win95 while maintaining the ability to play games, etc. I understand that Service Pack 2 will let me use NT to play games, but I have also heard that it's chock full of bugs. Any suggestions about how to get the most out of NT while maintaining it as my only operating system?

J. Brady

Associate disc editor Sean Cleveland replies: *Finally, somebody complaining about NT game compatibility! And I thought that I was the only one.*

It all comes down to DirectX compatibility and the fact that NT currently supports only DirectX 2.0. This is fine if you have games that only require DirectDraw and DirectSound, such as Diablo *or*

▶ 8

Deadly Tide. *It's not so good if you want to play any game that requires any of the other DirectX APIs. The other problem with NT is its ability to deal with sound. Games that use the Dos4gw engine, such as* Doom, Duke Nukem 3D, *and* Blood, *will lock up when trying to lock down a sound device. You can get around this by disabling the sound—not as fun to play, but it does work.*

The best way to get Microsoft to address these issues is to become more vocal and hope that they add full DirectX support in the next revision of NT.

By the way, you should upgrade to Service Pack 2 because it contains all the bug fixes. We haven't had a problem around here with it—yet. Further info regarding SP2 can be found on the web at www.microsoft.com/NTServerSupport/Content/ServicePacks/Insp.htm.

AMD VS. INTEL

It appears AMD might kick Intel hard enough to get them to put some real technology out the door. AMD K6 is already functioning at 233MHz, and will fit into good old Socket 7 (no Mommy upgrade). What's more, the front-end bus will run at l00MHz, not a max of 66MHz like Intel's Spammoth! AMD K6 is due out April 3, but I haven't seen anything about it in any mags. What gives?

Ken Tope

Technical editor Chris Dunphy replies: *AMD does indeed seem to be on the fast track with the K6, and I am stoked to get my hands on one. Rest assured that* boot *will give this chip plenty of coverage as soon as we have one in to test, hopefully in time for next month's issue.*

The support for a faster bus and MMX compatibility should really give Intel something to sweat about, but then again, AMD is just a fly to Intel. They would just as soon swat rather than sweat such a tiny competitor.

CYBERCRAWLING

I surf over a Tl line at my university library, and I don't see much, if any, speed difference between the Tl and surfing with my 28.8 modem connected to a local ISP. Granted, with more than 20,000 potential users, the line can get crowded, but I still get about IK/sec regardless of the time of day. Is the net getting so slow that 28.8Kbps is more bandwidth than you can use?

Alan Robinson

Executive editor Jon Phillips replies: *Congrats, Alan, you've stumbled into the abyss of Internet conjecture. Almost anything could be causing the slow throughput: your computer, misprogrammed routers, anything. Perhaps the servers from which you're requesting data are overburdened and underpowered (servers manufactured in the 1800s are notorious bandwidth offenders). And perhaps simply too many randy college students are downloading multimeg porn files at the same time: When a bunch of people tie up a high-bandwidth pipe with simultaneous requests for large multimedia files (as opposed to itty-bitty chunks of straight-text HTML), these continuous streams of incoming data slow activity to a crawl for all.*

Is the net getting slow in general? No. In fact, all major backbone providers are investing in bandwidth to accommodate its growing popularity. For example, MCI, whose backbone handles some 40 percent of Yankee Internet data, is on a steady mission to upgrade their pipes from T3 (45Mbps) to 622Mbps—and even faster speeds in the future.

As Internet backbones become increasingly thick, you'll be able to more confidently blame bottlenecks on punk-ass servers in Peoria, and crowded Ethernet networks on local turf.

If you'd like to stumble out of the conjecture abyss, get your university to invest in a little Netscape plug-in called Net.Medic from VitalSigns Software (www.vitalsigns.com). This revolutionary dynamo will report exact throughput numbers during downloads, and point out precisely where pesky bottlenecks reside.

MATROX REBUTTAL

As I read tech editor Chris Dunphy's reply in Comm Port (*boot* 08) about the Matrox Mystique's inadequacy as a gaming 3D accelerator, I began to question your almightyness. In no way is Matrox trying to pit the Mystique against Voodoo-based boards. We at Matrox have no problem admitting that Voodoo-based boards are the *crème de la crème*, and allow for fast frame rates with excellent visual aesthetics.

"We at Matrox have no problem admitting that Voodoo-based boards are the crème de la crème."

Yet, in the case where an add-on 3D board isn't feasible (cost, no open slot...), the Mystique makes for an excellent gaming board! It's my understanding that, given the choice, a gamer would sacrifice visuals for faster frame rates. What's the use of playing a Doom-like game at l5fps even though the walls are filtered? FYI, this is not a letter from the marketing department. It's just me at home on Saturday, bewildered by how many game magazines (boot included) could crucify the Mystique for providing fast 3D gameplay at the cost of some features.

Jason Della Rocca,
Developer Relations Representative,
Matrox Graphics Inc.

CD-ROM ON DVD

Back in *boot* 03, you talked about DVD and how fast it would load DVD-ROMs. Since DVD are backwards-compatible, will DVD drives read regular CD-ROMs just as fast? If so, will there be a SCSI version?

Roger Matthews

Hardware editor Andrew Sanchez replies: *DVD drives will read regular CD-ROMs—the actual transfer rates will depend on who's DVD drive you bunk with. Take a peek at our first-generation DVD-ROM system roundup on page 64. We've found that they'll range from 6x to about 8x comparable performance. As far as a SCSI version, it's funny you should ask. We just got Pioneer's DVD-301 SCSI DVD-drive in for some poking and prodding. We'll have full details on how this puppy performs in next month's issue.*

CALLING BUNKUM

Is Intel's Mike Aymar a company man, or just playing stupid? How can he possibly compare Intel's and Microsoft's influence to Compaq's and Sony's (Lip, *boot* 08)? I don't mind company men wanting to be good team players, but these guys should realize, that mags like *boot* keep the consumer smart enough to know doody when we smell it.

Vern Shields

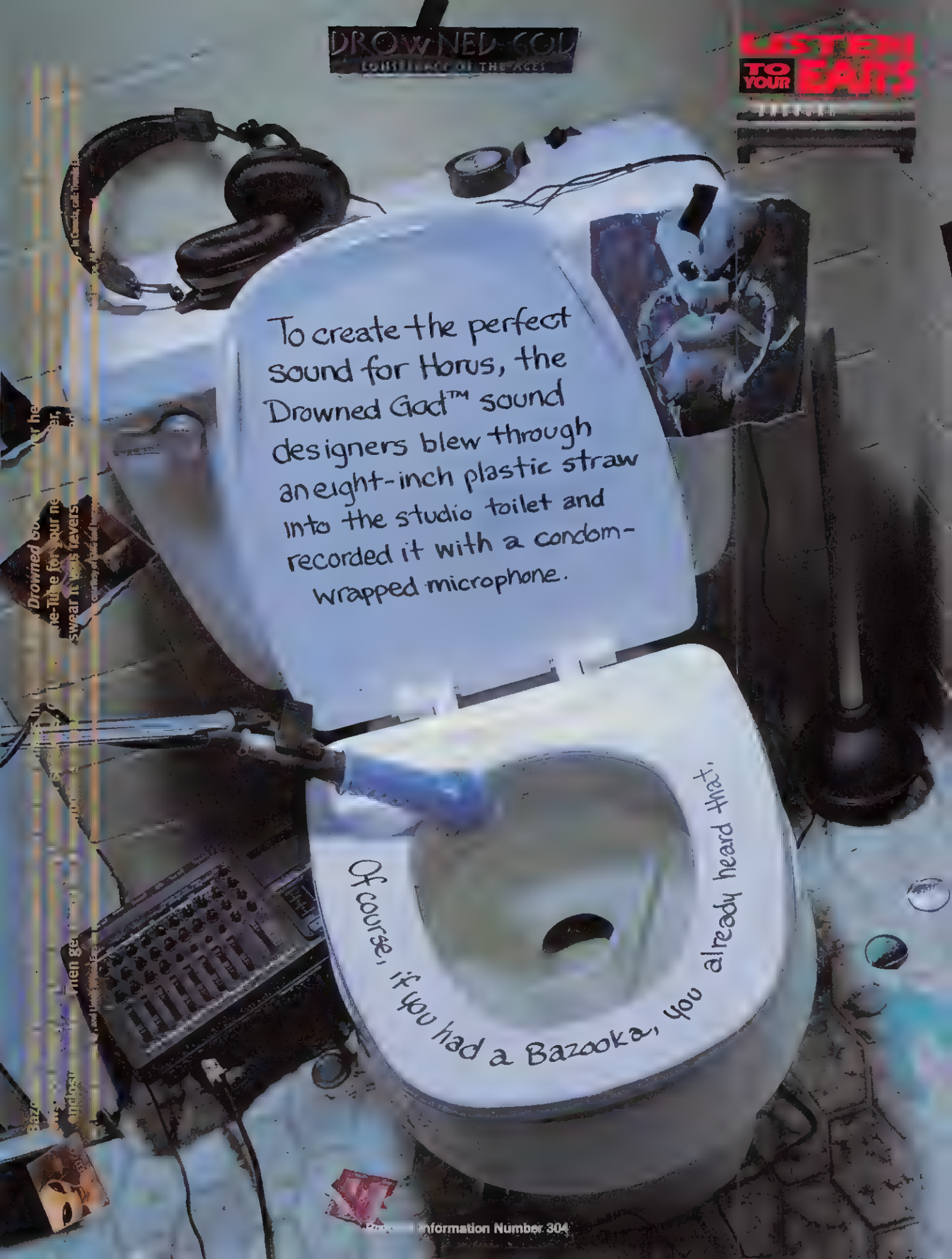
CUT, COPY, PASTE

The correct phone number for Canopus (Total 3D review, *boot* 06, page 80) is 888.868.2533.

The columns in the Dare to Compare table (Syquest SyJet review, page 84, *boot* 09) comparing the Iomega Jaz and the SyQuest SyJet were accidentally swapped. The SyJet's stats should have read:
Capacity 1.5GB; Price of Drive: $499; Price of Cartridge: $124.95; Price per MB: 8 cents;
Performance Tests:
Photoshop: 1 min, 35 secs; Copy To: 2 mins; Copy From: 51 secs; Video Capture: dropped 5 frames.

Black Dragon's webmaster notified *boot* that when Gillian Bonner said "All software is pornographic," in the Lip interview (*boot* 09) she meant to say: "All software with sexual content that [she's] seen is pornographic."

e-mail: commport@bootnet.com
fax: 415.468.4686
paper: boot commport,
150 North Hill Dr., Brisbane, CA 94005


DROWNED GOD
CONSPIRACY OF THE AGES
LISTEN TO YOUR EARS
To create the perfect sound for Horus, the Drowned God™ sound designers blew through an eight-inch plastic straw into the studio toilet and recorded it with a condom-wrapped microphone.
Of course, if you had a Bazooka, you already heard that.

boot DISC TEN

Every month, ***boot*** magazine delivers 600+MB of the hottest software and exclusive demos. If it piques your interest in the magazine, look for the ***bootDisc*** logo and you'll find the fattest demos and coolest apps to complement our cutting-edge previews, reviews, and features.

Demos:

Win95. Interactive session where you find yourself in a fist-fight to the death. **See the review on page 107.**

Win95. Fully functional demo has a few of the levels offered in the full version. **See the review on page 80.**

Win95. Demo has three holes, one animated golfer, and stroke play only. **See the review on page 87.**

Win95. Demo gives you Instant Action in a P-51 Mustang against several fighters. **See the review on page 83.**

Win95. Demo allows you to fight battles in a limited scenario. **See the review on page 86.**

Win95. Demo allows you to build three-hole golf courses. **See the review on page 87.**

DOS and Win95. Demo contains the first eight levels of the full version. **See the review on page 101.**

DOS and Win95. Demo has limited features and gameplay time. **See the review on page 106.**

DOS and Win95. Fully playable demo includes two missions. **See the review on page 86.**

Win95. Evaluation version of full application expires after 30 days. **See the review on page 82.**

Win95. Demo consists of a single mission and a few of the vehicles. **See the review on page 91.**

Win95. Demo of the Duel, which is one of four segments from the full game. **See the review on page 96.**

DOS and Win95. Demo requires full version of *Duke Nukem 3D* or *Atomic Edition*. **See the review on page 101.**

Win95. Fully functional demo with some weapons and vehicles from the full version. **See the review on page 75.**

Win95. Fully interactive demo of an exhibition game. **See the review on page 106.**

Feature: The bootMarks

Included on this month's *bootDisc* are the *bootMarks*, a suite of applications that comprise the grueling benchmarks we use to test a system in the bootLab. No single benchmarking app can fully test a system's performance so we came up with a set of 10 that do.

Check out the system reviews in this issue, and then install and run the *bootMarks* included on the *bootDisc*. All the directions about how to benchmark are in this month's 12-Step Program on page 49. Find out how your beast compares, then take your results and add them to our survey on the *bootNet* web site: www.bootnet.com/workbench/readers_bootmarks.html.

DOS and Win95. Demo is one-third of the first level of the full version. **See the review on page 101.**

Win95. Fully playable demo offers one of seven missions available in the full version. **See the review on page 106.**

Win95. Fully functional demo minus ability to save, record, or use the clipboard. **See the review on page 67.**

DOS and Win95. Demo offers access to all technologies except campaign mode and bosses. **See the review on page 72.**

Win95. A one-level demo with MMX and 3Dfx-enhanced support. **See the review on page 103.**

boot Net

WARNING

THIS SITE CONTAINS GRAPHIC MATERIAL THAT MAY TURN YOUR LOVE OF PCs INTO AN OBSESSION

www.bootnet.com

bootNet sports many of the exciting features that make *boot* magazine such a valuable resource for the hardcore PC enthusiast. There are reviews and previews, bootWorthy products, and an expanding archive of articles from past issues of *boot* online for easy reference, complete with a search engine.

Reviews

The Reviews section contains all the past *boot* reviews in a format that's as easy to browse as it is to search. Make an informed decision before you make that next purchase!

Survey

Help us to help you. We want to know about the PC fanatics who read *boot*. Every month we'll have a fresh survey for you that we'll then use to tailor *boot* to your needs.

bootWorthy

An archive of the best. Every bootWorthy product we've covered is here for you to compare and contrast, complete with side-by-side comparison charts and in-depth details you just won't find in any other magazine.

The *bootDisc* is compatible with both Windows 95 and 3.x. Run start95.exe to launch under Win95, and start31.exe under Win3.1. *boot* recommends a Pentium 90 or better with 16MB for access to all the software that's included. Slam the *bootDisc* into your CD-ROM drive to give yourself an injection of Pure PC Power.

NUGGETS

Downgrade or Die

Scott McNealy, president and CEO of Sun Microsystems Inc., is urging PC users to ditch Win95 applications for Java-based solutions.

To facilitate this, Sun will be releasing a "downgrade kit" for Windows-based computers, consisting of a Java virtual machine and a set of office applications written in Java.

"We've been bludgeoned to death with the idea that our kids need to know how to operate a Microsoft computer," says McNealy. "The downgrade kit will wipe out everything that is Microsoft, except DOS, and rebuild the system on open Java standards."

The kit, which costs about $99, will be available for downloading from the Internet. The release date is yet to be announced.

GIVE ME MY MMX!

A market research report from Computer Intelligence found that more than 25 percent of all desktop PCs sold in January were equipped with MMX technology.

Although MMX-based machines weren't officially available until the second week of January, they still accounted for the highest share of desktop PC unit sales and outpaced and outsold other similarly equipped systems containing plain-vanilla Pentium chips. Systems from IBM, Hewlett-Packard, Compaq, and Packard Bell accounted for over 90 percent of all MMX systems sold.

Despite Intel's efforts to keep MMX under wraps until after the holiday shopping season, the strong sales indicate that consumers either decided to wait (leaving the regular Pentium-based systems collecting dust) or were in a rush to become early adopters of MMX technology.

EXCITED yet?

Excite Inc. plans dramatic changes to its Internet search engine (**www.excite.com**), shifting its product-based model to one mirroring a television network.

Not all of the channels have been defined yet, but the rollout is expected to include topics such as arts and entertainment, sports, computing, and Internet-related issues. All of the channels will feature topical news, directories, bulletin boards, chat, and search capabilities.

"The next evolution of the web is really about creating an online experience that mimics the experience of other media," says George Bell, Excite's president and CEO. "The channel model will work for Internet audiences the way cable television does, and will simplify the consumer experience [of the net] by leveraging navigational habits learned from TV."

Hello, My Name is Bryan and I'm a Webaholic

According to the Canadian Medical Association and the University of Pittsburgh, Internet Addiction Disorder (IAD), a maladaptive pattern of Internet use leading to clinically significant impairments or increased levels of distress, is just as serious a problem as alcoholism.

Researcher Kimberly Young says the social problems of IAD, including job termination, social isolation, marital discord, and excessive financial debt, strongly parallel those of other addictions. A support group (aptly named the Internet Addiction Support Group) has been formed to deal with the exponential increase in cases of IAD. If you find yourself giving up important social, occupational, or recreational activities due to obsessive Internet use, you may be at risk. Check out **www.iucf.indiana.edu/~brown/hyplan/addict.html** for more information.

HIPPOCRATIC OATH FOR PC FANATICS

Never write a line of code that someone else can understand.

Type fast, think slow.

Bury everything in macros.

Bury the macros in included files. Reference those included files indirectly from other included files. Use macros to reference those included files.

Never code a function to return a value. All functions must return a pointer to a structure which contains a pointer to a value.

Always speak in abstract terms. If they can understand you, they don't need you.

Never complete a project on time. If you do, people will think it was easy, anyone can do it, and they won't need you anymore.

When someone stops by your office to ask a question, talk forever but don't answer the question, because if they get their questions answered they won't need you anymore.

When someone asks you out to lunch, just reply: "I can't because I almost have my RISC-based OSI/TCP/IP client connected by BIBUS VMS VAX, using SMTP over TCP, sending SNMP inquiry results to be encapsulated in UDP packets for transmission to a SUN 4/280 NFS 4.3 BSD with release 3.6 of RPC/XDR supporting OSR/2 and USB working."

ILLUSTRATION BY RUDY SPEERSCHNEIDER

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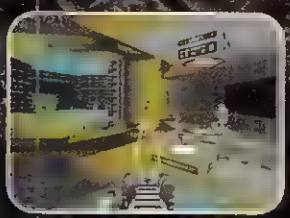

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Product Information Number 155

Virtual Reality files for Chapter 11

Head-mounted displays dead on arrival

Interested in virtual reality hardware? Better act fast. Most, if not all, of the companies producing consumer-grade VR have either declared bankruptcy or—even worse—no longer exist. The most recent casualties, fierce competitors Virtual i-o and Forte Technologies, even filed for Chapter 11 protection on the same day in late February, leaving many doubting whether VR will ever become a reality for the masses.

"The missing link is software," says Linda Jacobson, Silicon Graphics' virtual reality evangelist. "The hardware isn't entirely mature, and without the proper software, the hardware doesn't stand a chance of surviving."

Survival has proved to be beyond most companies that invested heavily in VR development. Sega spent millions developing and testing a head-mounted display (HMD) for platform gaming, but killed the project after testers experienced intense nausea and other ailments. Nintendo didn't learn any lessons from their rival's disaster and proceeded to release the doomed VirtualBoy—an HMD that didn't HM, instead requiring a tabletop tripod.

Hasbro spent almost four years and $60 million attempting to develop an HMD-based game system, but bailed in 1995 when the hardware costs could not be reduced to consumer levels. Victormaxx Technologies got out of the game when gamers rejected its StuntMaster and CyberMaxx headsets. Even Virtuality—king of location-based VR—has filed for protection from creditors. The one standout is Mattel's PowerGlove, introduced in 1989. While, it too, failed to catch on with gamers, it's still credited as one of the first consumer VR products to be even a moderate success, and is still a favorite among garage-VR enthusiasts.

At the summer CES in 1994, Virtual i-O introduced the PC version of their i-glasses, a lightweight HMD with motion tracking capability. While promoted as having an interactive 80-inch screen, the product actually delivers a twin-LCD display with a 30-degree field of view and a screen resolution of only 263x230. Despite winning a slew of industrial design awards, the product was never a hit with consumers. Nationwide retailers (including CompUSA and Computer City) dropped the product when shoppers balked at the nearly $800 price tag, and those brave souls who shelled out the money returned the devices at rates approaching 100 percent. After an expensive ad campaign failed to muster sales, Virtual i-O repackaged the unit with a new name—VPC—and tried selling it at $599.

Today, the company awaits majority owner TCI's verdict on what exactly to do with the $20 million failed investment (half of which was a loan).

Chances are that Virtual i-O will either be sold or closed down. On the off chance they're kept alive, the company will "most likely move away from the consumer market and into more vertical ones," according to Bob Schneider, vice president of sales.

Virtual i-O's other financial partners, including Intel ($1 million), Planar Systems ($2 million), and Thomson-CSF ($6 million to $9 million), will end up writing off their investments. European distributor Escom AG also invested about $4 million, but they are no longer in business. "We never counted on a big financial windfall," says Pierluigi Zappacosta, vice chairman of Logitech (which invested about $1 million), "and we always write off these kinds of investments over time."

by Bryan Del Rizzo bdelrizzo@bootnet.com

Products such as the i-glasses and the VFX1 promised big-screen thrills and chills, but the actual visceral experience was very subdued.

Forte Technologies has fared just as badly, but with far less money. Their major investor—Kopin Corporation—had no experience with the computer industry or consumer-level products. As a result, Forte's VFX1 HMD (priced at $999) failed even to dent the U.S. retail market, although the product was a minor success in Europe.

According to Ingram Micro, the world's largest distributor of computer software and hardware, the official figures for the VFX1 and i-glasses are dismal at best—only 420 VFX1s were sold in 1996. And i-glasses actually posted negative sales numbers (-5) during the same period.

As bad as all this sounds, VR isn't dead. Although consumer VR can be laid to rest, the death of such rudimentary hardware doesn't necessarily mean the demise of the virtual reality community. Companies such as SGI are developing VR products, most of which are designed for vertical markets including training, medical, and education. SGI further showed their commitment to VR when they built the Visionarium, which has seating for 40 and a 160° wraparound screen to show off sophisticated, multi-pipelined 3D graphics. Other companies, including StereoGraphics, SENSE8, Superscape, and Fakespace are also continuing VR development, and with VRML supposedly ready to take off, VR may someday become a reality. But unless prices drop and the technology dramatically improves, don't expect home-based VR until the next millennium at the soonest.

DIRECTX 5.0 is coming

It's not just for gamers anymore

DirectX, originally created to entice game developers to the Windows 95 platform, was plagued by innumerable bugs, incompatibilities, and driver problems that made it Microsoft's bastard son. Now with the recent release of the DirectX 5.0 beta, Microsoft is once again jockeying to be the premier provider of APIs for multimedia development.

"We've paid close attention to quality control," says Leslie Evans, product manager of the Microsoft's DirectX Games Market. "We believe this to be a rock-solid release."

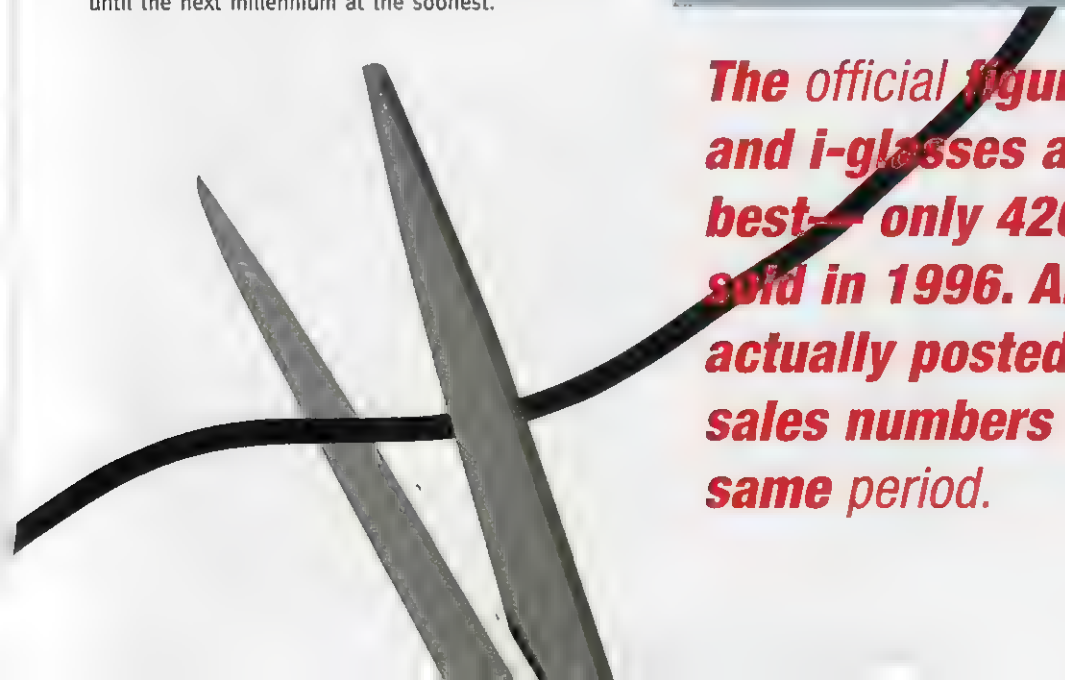
DirectX 5.0's new features—including support for USB, FireWire, MMX, AGP, 3D sound acceleration, DMA bus-mastering, and force-feedback controllers—should placate even the harshest critics. And with the inclusion of the DirectDraw Primitive API (a subset of Direct3D that simplifies access to 3D hardware) and new Talisman rendering features—including anti-aliasing, anisotropic texture filtering, and range-based fog—there may even be enough to satisfy id Software's John Carmack, who has called previous releases of DirectX "a horribly broken API."

"John is one of our key developing partners, and we continue to work closely with him," says Evans, who promises key developers will have "direct influence" on DirectX.

To make DirectX 5.0 easier to implement, Microsoft has significantly improved development documentation, added additional peripheral support, and is including more sample code and libraries to assist developers. In the hope of making Win95 a unified development platform, Microsoft has also integrated ActiveX for develop-ers creating Internet-specific content. Two new file formats, DirectX files and Active Streaming Format, will enable developers to easily incorporate predefined objects into any DirectX-compatible application and stream content over the Internet.

Installation has been completely overhauled to eliminate end-user problems, such as driver updates and version incompatibilities. Microsoft also plans to provide a database of all supported cards and peripherals, which users can browse to make sure their hardware is supported.

The final release of DirectX 5.0 is expected in late June; and lest you thought 5.0 was the last revision, think again. Microsoft plans to release subsequent updates at least twice a year.



The official figures for the VFX1 and i-glasses are dismal at best—only 420 VFX1s were sold in 1996. And i-glasses actually posted negative sales numbers during the same period.

AMD & Cyrix slapped with a Lawsuit

Intel seeks permanent injunction to protect MMX

Two days before unveiling K6, AMD executives weren't planning a release party for their MMX-killer. Instead, they were huddled with a crack team of defense lawyers, devising last-minute strategies in preparation for another showdown with Intel—this time in court.

Intel's lawyers allege that AMD and Cyrix infringed upon an Intel trademark—MMX—and have urged the court to prohibit both AMD and Cyrix from marketing, promoting, or selling any products containing the MMX mark in any literature, packaging, or advertising. AMD and Cyrix would also be restricted from incorporating the word "MMX" in a product name (such as the K6-MMX processor, for example).

Although Intel has filed a claim for MMX, the U.S. Trademark Office hasn't yet cleared it for publication—and even if the trademark is cleared, it can still be challenged.

AMD credits Intel with creating the MMX nomenclature, but they believe it's part of the public domain, and as such, shouldn't be given trademark protection.

"The term 'MMX' was originally used by Intel as a short form for multimedia extensions," says AMD spokesman Scott Allen. "The fact that they came up with it and popularized it doesn't necessarily mean they're entitled to trademark protection."

The April 1 court date is the first in what is sure to be a long, drawn-out process. Had Intel convinced a judge to grant a temporary restraining order against AMD, K6's launch would have certainly been compromised. But, even though the judge denied the restraining order, AMD claims Intel's timing was devised to sabotage the K6 announcement.

According to Intel's Chuck Mulloy, Intel asked the court for an immediate hearing on the matter upon learning of AMD's plans for an extensive ad campaign to coincide with the K6 launch. He says the date was set by the court, and not by Intel.

"We didn't set that particular date, and there was no specific intent to sabotage [AMD's] announcement," says Mulloy. "We were simply doing what we believe was our right—to protect our trademark, and prevent it from becoming a generic name. That was our sole motivation, and we didn't time it for April 1."

A hearing for a preliminary injunction is scheduled for late April, which, unlike temporary restraining order hearings, are usually much more in-depth. More evidence is presented, witnesses called, and the court's deliberation usually take longer. If the dispute isn't resolved, both parties proceed to trial. (Intel has asked for a trial by jury.)

As for Cyrix, they've decided that a long court battle isn't worth the expense, and have agreed to give Intel appropriate attribution for the MMX mark. They've also agreed not to use MMX in the product name of their new processor, code-named M2, slated for release early this summer.

"Cyrix always held a similar belief with regard to MMX as AMD does, but we've tried to resolve the MMX issue amicably," said a Cyrix spokesman.

AMIGA rises from the dead

Gateway 2000 bids for Amiga patents, trademarks, and trade names

Gateway 2000 has offered to acquire Amiga Technologies. The deal is still subject to regulatory approval and would secure all patents, trademarks, and trade names.

Amiga Technologies, which was bought last year by the now-defunct German company ESCOM AG, would be renamed Amiga International and continue to create and develop new products for the diehard Amiga market.

"The acquisition is good news for Amiga fans and helps to solidify Gateway's position as a technology leader," says Rick Snyder, president and COO of Gateway 2000.

The A/Box, an Amiga-compatible supercomputer, has impressive specs—a 500MHz Motorola processor, FireWire interface, and four audio-out ports—but it must beware the BeBox's fate.

"The Gateway 2000 announcement is a surprise that holds much promise," says Dan Robinson, director of business development for QuikPak, a leading supplier of Amiga-based systems. "It represents an excellent opportunity to breathe new life into the Amiga platform."

QuikPak previously attempted to buy the Amiga platform, as had another technology company named VIScorp, which could not pony up the $20 million.

When pressed for information, Gateway 2000 spokespersons told *boot* that no further announcements will be made until the deal is approved.

As expected, this lack of information has Amiga enthusiasts concerned about Gateway's intentions.

Gateway could be leveraging its patent portfolio for day-to-day business negotiations with other companies. Although none of the Amiga patents are particularly exciting, a few—including one relating to pull-down menus that aren't displayed until you click a mouse button—could be cross-licensed.

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Sweepstakes Rules No purchase necessary. Contest open to U.S. residents only. To enter you must enter your personal information at the PowerVR Sweepstakes website (www.powervr.com/register) or write your name, address, city, state, zip code, phone number, age, and e-mail address on a 3" x 5" card and mail to NEC PowerVR Sweepstakes, 2880 Scott Blvd., Santa Clara, CA 95052-8062. Limit one entry per person. All entries must be received by 7/10/97. The prizes are (1) Gateway 2000 Destination DX6-266 Computer system with 31" VGA monitor (ARV $4,499) and (1) Compaq Presario 8772 Computer System with Presario 1725" monitor (ARV $3,599), (15) VideoLogic Apocalypse3D video boards, including MechWarrior 2 and Ultimate Race games (ARV $199 each), (100) VideoLogic Apocalypse3D T-shirts (ARV $15.00). Contest is open to all except employees of NEC Electronics, VideoLogic, Imagine Publishing, Electronic Boutique, Compaq Computer Corporation, Gateway 2000 Inc., and their parent companies, subsidiaries, retailers, advertising agencies, promotion agencies and the immediate families of each. The prizes will be awarded, and the Grand Prize winner will be notified by mail. Prize winners will be randomly selected from all eligible entries received. Drawing will be held on or about 7/15/97. All decisions are final. The Grand Prize winner will be required to complete an Affidavit of Eligibility, to be returned within 15 days of notification. If completed Affidavit is not received within 15 days, or if prize notification is undeliverable, an alternate winner will be selected. By entering this sweepstakes, entrants accept and agree to be bound by these rules and the decisions of the judges, which shall be final. If a minor wins a prize, it will be awarded to his/her parent or legal guardian. Odds of winning depend on the total number of eligible entrants received. The sponsors of this promotion reserve the right to substitute prize of equal value if prizes are unavailable. No substitutions or transfers of prizes allowed. Taxes are the sole responsibility of the winners. Offer void where prohibited, or restricted by national, state or local laws. By submitting an entry, a potential winner agrees to allow use of his/her likeness and/or photograph for advertising without compensation unless prohibited by law. © 1997 NEC Electronics. All trademarks and logos are property of their respective owners.

Product Information Number 253

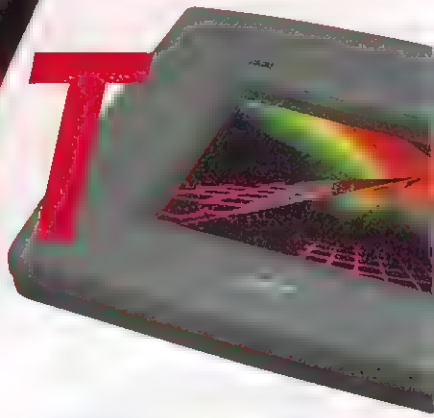
PURE LUST

HIGH-TECH **TOYS** AND **TOOLS** WITH THE RIGHT STUFF

SHARP EYE *From Olympus, the Sahara series binoculars are durable, pocket-size, and powerful peepers ideal for sports fans and outdoor adventurers. The 10x24 PCII model features Bak-4 prisms to provide the sharpest image, a dioptric corrector to adjust the lenses to your eyesight, and foldable rubber eyecups. The $137 binoculars are 3.4x3.9x2.2 inches and weigh in at 8.8 ounces. The lenses are composed of six elements in four groups with a 264-foot field of view at 1,000 yards for a wide and close look. Olympus America Inc.: 800.247.9674; www.olympus.com*

EATING SMART *climbed … there's a … Targeted at computer users, the Think! … nutrition bar" provides sustenance for the … mind with natural stimulating ingredients inc… … and ginseng. For years, h… nuts have been claiming that these Chinese herbs and amino acids increase blood flow to the brain to m… think more clearly. Both flavors—Chocol… and Ha… Coconut and Peanut Butter Chocolate—pack around 225 calories and 4 to 6 grams of fat in each $1.49 2-ounce bar. It should be noted that, according to the Think! documentation, a portion of those fat grams are MCTs, "a high-energy triglyceride fat that is not stored by the body like conventional fat." Whatever. Goes great with Jolt cola. Personal Health Development: 800.643.2057; www.thinkproducts.c…*

BIG PRESENTATION *The new QA-2500B is a high resolution XGA (1024x748) LCD multimedia projection panel from Sharp promises 50 percent higher light transmissivity than earlier models. The secret is in Sharp's 10-inch thin-film transistor technology, which enables the QA-2500B produces 16 million clear and bright colors. A wireless remote control has a built in tracking for computer mouse and pointer controls and selecting special effects. Designed with an open architecture, the $7,995 panel displays XGA, SVGA, VGA, and Mac images and is compatible with numerous platforms including the IBM RISC 6000, DEC Alpha Station, Sun SparcStation, and Apple Macintosh systems. Sharp Electronics Corp.: 800.237.4277; www.sharp-usa.com*



POUND FOR POUND *The T-Fal Evidence IMC Infrared is the weighing scale you would find in the Jetsons' dream house. Don't bother squinting down to see how many pounds that pizza added—this scale displays your weight on the wall in front of you via an infrared remote LCD. But the most interesting feature of the $119 IMC Infrared is its ability to identify up to four users based on the way they stand on the scale. Step on and the remote screen first displays your weight and then any gain or loss since the last time you checked. Remember, you're only lying to yourself. T-Fal Corp.: 201.575.1060*

LOOK OVER THERE *Canon's Hi8 ES6000 camcorder offers a very sci-fi feature—many of its functions can be controlled simply by moving your eye. The proprietary Eye Control System tracks the movement of the user's eye using an infrared beam to automatically focus the camera on any subject within the viewfinder frame. In addition, selecting one of seven eye-controlled switches enables you to start and stop recording, activate fade, set the white balance, display the date/time or title, or engage other digital effects simply by looking in a certain direction. As if it needs anything more than the Eye Control System, the $1,699 ES6000 still features a 20x optical zoom/40x digital zoom lens, color viewfinder, stereo audio, and RC time code for precise editing. Canon USA Inc.: 516.328.5000; www.usa.canon.com*

SURGE RELIEF *Surges, brownouts, and blackouts are a bummer. To protect your data, pick up American Power Conversions' Back-UPS Office, a multipath power device and surge protector with a battery backup for CPUs. The six outlets all feature EMI/RFI filtering, and three of the jacks offer battery power for data protection. The user-replaceable battery automatically provides seven to 13 minutes of power during a blackout, giving you time to hit to save your data or keep typing before you forget that million-dollar idea. Back-UPS Office sells for $179 and includes a $25,000 lifetime Equipment Protection Policy. American Power Conversion: 800.877.4080; www.apcc.com*

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I, ROBOT-BUILDER *Designed for older kids (7+!?!?), Learning Curve's Robotix system of motorized construction kits is based on the scientific principles of robotics engineering. Robotix is the Erector Set of the information generation. Using interchangeable parts, motors, a multi-channel controller, wireless remote, or hand-held programmable computer, you and your kids (or just you!) can build many different models from each set based on easy-to-follow instructions or your own designs. Parts from all the kits are completely compatible and reusable, with prices ranging from $39 for the Robotix 1000 starter set to $139 for the Computer Set. Learning Curve: 800.704.5697; www.learningtoys.com*

NO EXCUSE FOR NO REPLY *[illegible] you when you're out, but keeps you in touch as well. The GSC 100 is a global satellite communicator that uses ORBCOMM, a new Earth-orbit satellite communication system, to enable the user to send and receive e-mail anywhere in the world. Retailing for $999, the unit stores up to 100 text messages and features an address book with up to 150 entries. The integrated GPS system features six graphic navigation displays, a real-time track plotter, 200 user-defined waypoints, and five reversible routes of 15 legs. Powered by a 9.6 V DC rechargeable nickel-cadmium battery pack, the GSC 100 weighs 37 ounces and measures 6.5x 7.5x 1.75 inches. Magellan Systems Corp: 909.394.5000*

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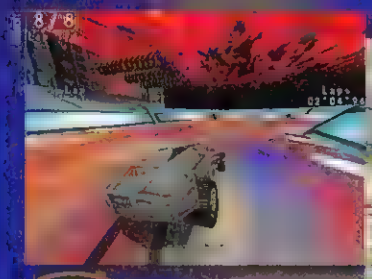

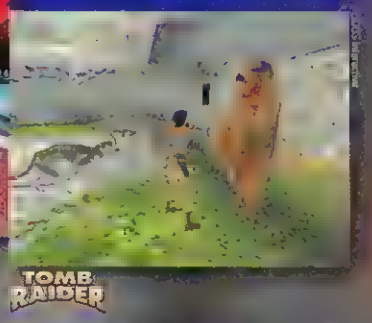

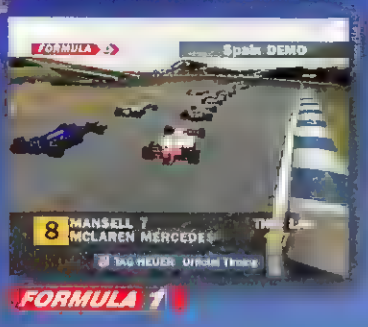

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Product Information Number 374

CAN GAMES BE ART?

PETER GABRIEL'S LATEST CD-ROM POSES TOUGH QUESTIONS

It was the kind of party where you might be refused entry if you weren't wearing a black turtleneck and wire-rimmed spectacles. Lou Reed was there in leather pants, his face looking like a road map of Utah. Laurie Anderson was there, looking like a soccer mom. And our host Peter Gabriel was there as well, looking bald. Everyone was gathered in a second-story studio at the Chelsea Piers in New York for a press stop pimping Gabriel's latest multimedia project, *Eve*.

I couldn't understand more than five words of the actual game preview—thanks to a dodgey A/V system—so I had no idea what the point was when I sat down to talk to Gabriel.

It didn't really matter. Gabriel proved eloquent and savvy, holding forth on everything from bandwidth issues to the ability of technology to empower the Third World. He oozed artistic sensitivity, frankly acknowledging his limited gaming experience: "My multimedia department educates me on what's out there. I think what's important is the aesthetic. Some of the stuff which started as shoot 'em-ups is evolving into more psychological and spiritual areas. I think there's more of a feminine side coming out of a technology which started out as a sort of thrusting male provenance."

> "Some of the stuff which started as shoot 'em-ups is evolving into more psychological and spiritual areas. I think there's more of a feminine side coming out of a technology which started out as a sort of thrusting male provenance." — *Peter Gabriel*

But *Eve*'s intentions are lofty, and Gabriel, who is earnest to a fault, has a deep and abiding belief in the power of art to help us reach a better spiritual understanding. He is also quite sincere when he speaks of the liberating and transformational potential of games and the artistic legitimacy of the medium.

As Gabriel points out: "I'm not very satisfied with the visual concepts in existing musical CD-ROMs or virtual environments. The artists we used have real history in their own work and an integrity." Unfortunately, the work of the artists featured on *Eve* doesn't necessarily lend itself to a game environment. It's too abstract and self-indulgent, but we'll let them speak for themselves:

Yayoi Kusama: "The basic reason why I continue creating art derives from the fact that I was an unwanted child born of unloving parents, and have a mental and nervous disease resulting from the hopeless darkness of adolescence and the scars of the mind."

Cathy De Monchaux: "The physical and conceptual layers in the work are there because I don't see existence as a straightforward event."

Nils-Udo: "Creating works with the human body was a very important step for me because I previously thought Man was something impure and polluted."

Helen Chadwick: "The Piss Flower sculptures were made by casting piss holes in the snow. The beauty of making Piss Flowers was the freedom from artistic control, not being able to mediate and manipulate directly."

These are people who shouldn't be given sharp objects, much less the chance to make a game. We are obviously in a different orbit here: The intentions of a game like *Eve* and one like *WarCraft II* are eons apart. Gabriel thinks interactive entertainment can have the artistic integrity of a museum piece or work of literature. Is he right?

It's a complex question touching on issues ranging from the intersection of creative expression and entertainment to the definition of art itself, and it deserves a carefully considered, complex response. Here it is:

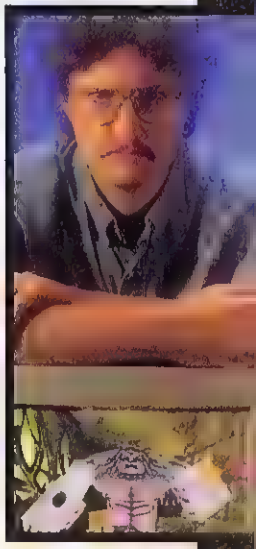
No.

Multimedia is not an artistic medium like painting, sculpture, music, or literature. Computer games are, by definition, interactive. Theorists' lofty claims aside, art is not interactive, it is the interpretive act of the artist on his medium. No game that has ever been created qualifies as art. The vistas of *Myst* or *Gadget* or *The Dark Eye* may be beautiful, and if hung on a wall they may even be called art. But when interaction is the key, they are merely wallpaper. The interaction is the point, and interaction, whatever fancy clothing you dress it in, isn't art.

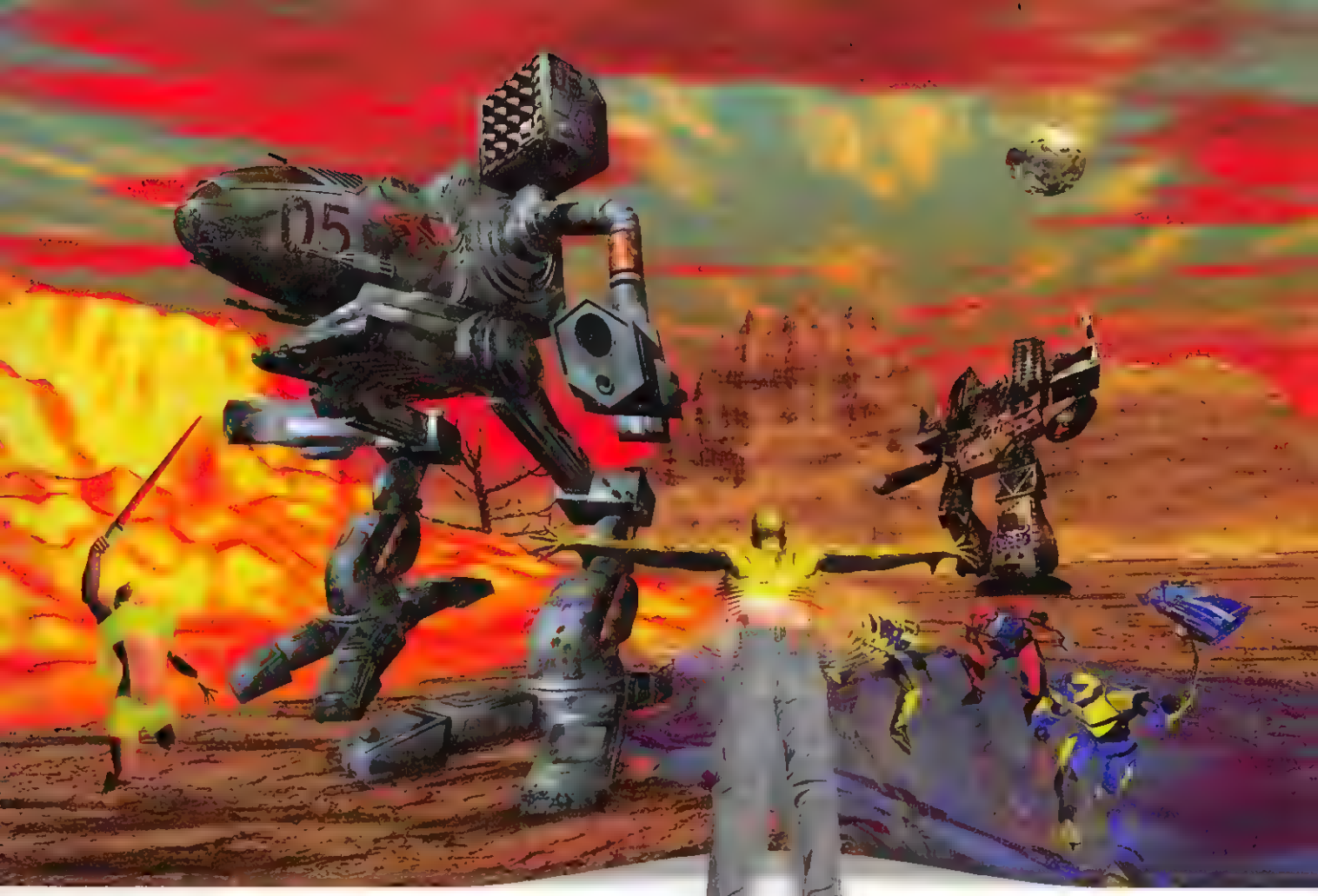
Eve is a ponderous jumble. You meander aimlessly and click endlessly, never quite sure what you did to get to the next portion. The intent was to craft an evolutionary interactive experience that helps you understand things in a new way through exploration.

Gabriel's dream project is one in which he works with "the most interesting minds in different fields—whether it is film, music, philosophy, psychology—designing experiences in a convincing way that people can be really active in and challenge themselves, as they do in life."

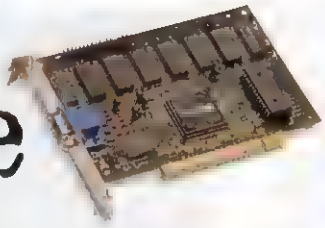
Can a game do that? Possibly. Can it do that and be entertaining? Not likely. If it does, "Is it art?" as the famous question goes. No, it is not. It's a game, folks. Like hopscotch or kick-the-can, it's an amusement. Games can skirt serious issues and may even force you to make decisions based on weighty issues such as morality and spirituality, but the motivator is always the same: get to the next screen, solve the puzzle, kill the foozle. You can't make a silk purse out of a sow's ear and you can't make a da Vinci out of a computer game. So let's stop pretending we're doing more than amusing ourselves for the moment.



T. LIAM MCDONALD is loathe to admit that he has a bachelor's degree in fine arts, and is a recovering Art Twit.



We'll take you there



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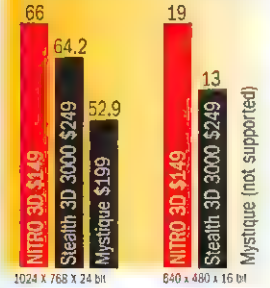

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Product Information Number 307

ALL I SEE IS 3D

THE INTERNET IS REBUILDING INTERFACES IN ITS OWN IMAGE

I'm supposed to write about the Internet, but today, I'm a woman obsessed and all I can see is 3D.

Today, 3D is not just about high-end workstations. It seems everyone is making a groundbreaking 3D accelerator card or some cutting-edge 3D software. Even Intel is making a 3D graphics chip. Why the rush? 3D is natural. We live in 3D. Our brains are wired for time-spatial memory. Our universe speaks in 3D.

The problem is, 3D is so ubiquitous that most of us can't figure out how to translate our 3D experiences to a 2D web site (for more intuitive navigation) or a desktop (for more intuitive information organization.)

Got a knack for visual 3D cues? Get rich quick.

Enter VRML to save the day.

Unlike Java, with its sugar daddy Sun Microsystems, VRML's many parents (Netscape, Microsoft, Sun, Silicon Graphics, IBM, Apple, Oracle, Adobe, Macromedia, Sega, Disney, Boeing, United Airlines, British Telecom, and Sony, to start) are united by a single vision: Open standards, built collectively, make good and long-lasting technologies. And VRML is only the second cross-platform, industry built, open standard to travel this mainstream path. (The first was HTML.)

With VRML, we are witnessing a simultaneous chicken-and-egg birth. The "egg" is the new technology—VRML as an industry standard for 3D on the web, and the "chicken" is the posse of corporations sinking hundreds of millions of dollars into VRML development.

VRML is riding the crest of all the Internet hype, so it will ultimately succeed. After all, people are too afraid of new web technologies to *not* take the bait. But its success can't be measured just by how many VRML worlds are springing up onto the Internet (though most sites will contain at least some VRML elements by 1999).

Instead, the true success of VRML will be seen in how many operating systems, software development kits, and even word processors adopt 3D as their primary interface.

Trust me. I've been slumming around the VRML scene for two years and babbling, somewhat tangentially, about the merits of a 3D interface. VRML will take us there.

We're talking about a complete shift in the software design paradigm. Kill the mouse and the double click! I want a 3D input device and the death of menus.

People are building 3D worlds on the Internet, but most are mere technology demos. See the bunny jump. Hear the dog bark. How do we keep the frame rate above 15fps? In recent months though, these demos have grown to conduct online transactions with an "intelligent" 3D robot and track several mining shipments across continents from a database back-end on a single web page and dynamically generate cross-platform multiplayer adventure games. Now the question is: How do we make avatars morph and have facial expressions?

> The kids growing up plugged into Sega are going to have a lot to say about being forced into a 2D paradigm. They won't tolerate it.

Perhaps the most interesting development can be found at the VRML section of Microsoft's web site. Though still 2D, the site has a 3D navigational bar down the side. Knowing Microsoft, do you think a VRML nav-bar would be there if there *weren't* larger plans for 3D interfaces?

Lycos also has a VRML-based 3D interface for its popular search engine. Others will follow. Advertisers are always looking for new gimmicks. Siegel and Gale, a leading corporate-identity company for the likes of Xerox and 3Com, has an entire team working with VRML.

How long will it be until people expect all their software to have a 3D interface? The kids growing up plugged into Sega are going to have a lot to say about being forced into a 2D paradigm. They won't tolerate it. It's arcane and confining, and the only reason *we* cope with 2D is because it's all we know. We've reconfigured our brains to accommodate it.

Imagine learning to use computers if you didn't have to rearrange the entire cognitive process... Remember, we are wired for time-spatial memory, not windows.

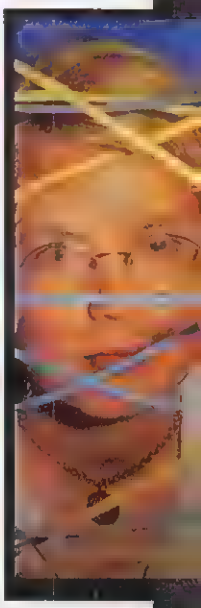
The success of VRML, first as an Internet standard and then as a mechanism for software user interfaces, *will* bring 3D to the desktop. In fact, Netscape's nifty *Constellation* (browser/OS dynamic duo) and Microsoft's oft-delayed Windows 97 (98 or 99) code-named Nashville or Memphis (or by now some other southern U.S. city) are ready and waiting for 3D.

Constellation layers are the first step in unlearning 2D, allowing us to easily apply 3D content over or under 2D content. And Netscape's decision to ship the *CosmoPlayer* VRML browser native with Netscape 4.0 is not an accident.

And while Microsoft already had all sorts of points of entry for Windows to go 3D via ActiveX, the recent acquisition of Dimension X, a VRML/Java company, and licensing of Intervista's *Worldview* VRML browser for *IE 4.0* points to a 3D future.

VRML is everywhere, and because of it, everyone's recognizing the importance of 3D, not just for content but for interfaces. Computers built the Internet in their image, and now the Internet is building computers in its image.

That's (r)evolution for you.



SHEL KIMEN (kimen@well.com) is editor-in-chief of vrml.sgi.com and evangelizes a world of open-standard, cross-platform systems. Or else.

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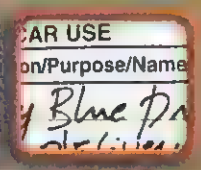

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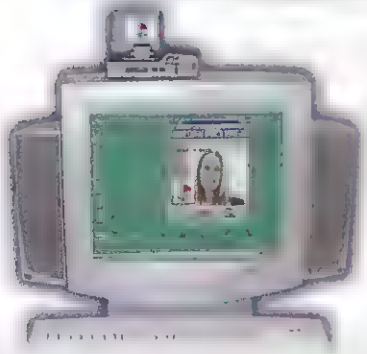

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These new modems won't carry us into the future of high-speed, media-rich networking. For that we need broadband speeds—roughly defined as megabits per second (Mbps). Even a conservative broadband data rate of 1.5Mbps is nearly 30 times faster than a 56.6 modem, and higher rates are feasible.

Last month I mentioned ADSL (asymmetrical digital subscriber line) modems, which work over copper phone wires; cable modems, which work over cable-TV coaxial networks; and wireless broadband modems, which either use terrestrial wireless networks or direct-broadcast satellites. All of these require a subscription that will be far less expensive than a T1 data line, which costs about $1,000 a month for 1.544Mbps service. In northeastern Ohio, Time Warner is offering its Roadrunner cable-modem service to about 300,000 Ohio households for less than $50 a month, including unlimited Internet access.

Even a conservative broadband data rate of 1.5Mbps is nearly 30 times faster than a 56.6 modem, and higher rates are feasible.

I estimate it will be five to 10 years before broadband data service becomes commonplace throughout the United States.

ADSL will work over millions of miles of existing twisted-pair phone wiring, so the telephone comoanies can deploy it in many areas without costly upgrades. Downstream data rates could hit 9Mbps under ideal conditions, but only if you tolerate slower upstream rates of 640Kbps or less. If you prefer a symmetrical connection (equal bandwidth in both directions), ADSL can deliver a faster upstream path at the cost of a slower downstream path. In any event, you'll always get the bandwidth you pay for, because ADSL works over phone lines that aren't shared among multiple users.

On the downside, ADSL should cost more than cable modem service at first, especially in areas where cable modems aren't available. The telcos won't want to undercut their lucrative business in commercial-grade data lines. Also, the phone network has a lot of antiquated wiring that will stop ADSL cold in some neighborhoods.

Cable modems must overcome network infrastructure problems, too. Coaxial cables have much more inherent bandwidth than phone lines—30Mbps or more downstream per channel—but the upstream path is a rat's nest of noise and radio-frequency interference. Consequently, cable modems must limit their upstream rate to a fraction of their downstream rate. But you'll still get megabits in both directions, so it's hardly worth whining about.

One often-cited drawback of cable modems is that all users in a neighborhood share the same bandwidth, which depends partly on how many local users are using their cable modems at the same time. This shouldn't be a major problem, unless all your neighbours are Internet junkies. And if there's really that much demand, it will be worthwhile for the cable company to allocate additional channels for modem service or to activate the extra fiber-optic cables that most companies routinely install when they upgrade their networks.

Wireless modems seem attractive because they don't suffer from these woes. But wireless networks need infrastructures, too—thousands of ground-based transmitters for new terrestrial networks and expensive transponder capacity for satellite networks. Users will pay directly for the client side of that infrastructure, because you have to buy a costly dish antenna and a receiver, not just a modem. And terrestrial networks need government approval for reallocated broadcast spectrum.

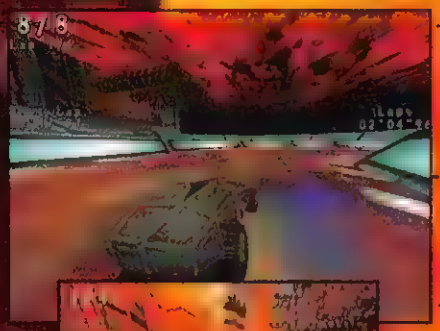
Today's satellite networks are widely available, but they have a major flaw: only the downstream data comes from the satellite. The upstream path is a regular 28.8 modem. Future networks will offer megabits in both directions, but they'll require new satellites.

The most ambitious new satellite system is envisioned by Teledesic. Backed by Bill Gates and cellular phone billionaire Craig McCaw, Teledisc plans to launch nearly a thousand satellites into orbit to create a broadband net-work that will cover almost the entire surface of the Earth. It will be a few years before this network gets off the ground (literally), and nobody has ever attempted a space project on such a vast scale. But if Teledesic succeeds, it could leapfrog ADSL and cable modems, unless the telcos and cablecos move very aggressively.

My best guess is that no single broadband technology will achieve both the ubiquity and the affordability to squeeze out all the others, at least for the next decade. If you're lucky, you'll live in an area that has two or three choices and the competition will keep prices down. Soon almost everyone will have at least one broadband option—and you can kiss your old modem goodbye. b

TOM HALFHILL is a senior editor at *Byte* magazine and the author of two computing books. He first became interested in computers during the disco era.

The Explosive Multi-player, Hypersonic Phenomenon Burns Serious Rubber...



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- Newsweek

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- ZDNet

"Moves as fast as lightning..."
- C|Net Gamecenter

"...the best multiplayer port I've seen..."
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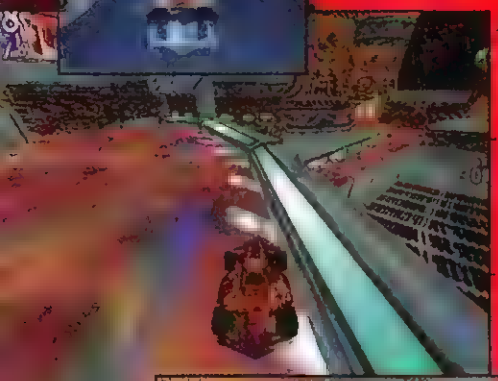

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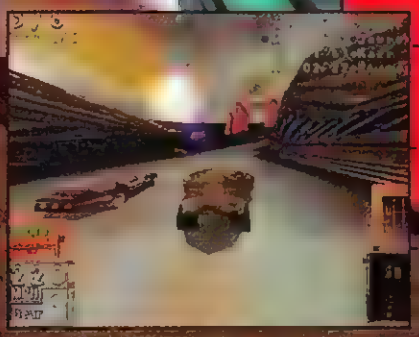

"Top Game... for Three Weeks!"
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"Site of the day!"
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Intel MMX
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On-Line Multi-player
(Internet-direct, local network, modem, direct link or split screen)
The fastest race on this planet... or any other
Designed for Windows 95
KIDS TO ADULTS
K-A
CONTENT RATED BY ESRB

FEATURES:

- Runs at up to 32 frames per second (80 using a 3Dfx graphic accelerator card!)
- 16 Tracks plus more downloadable over the Internet!
- Pre-calculated position engineering reduces latency over the Internet.
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KIDS TO ADULTS K-A CONTENT RATED BY ESRB

Designed for Windows 95

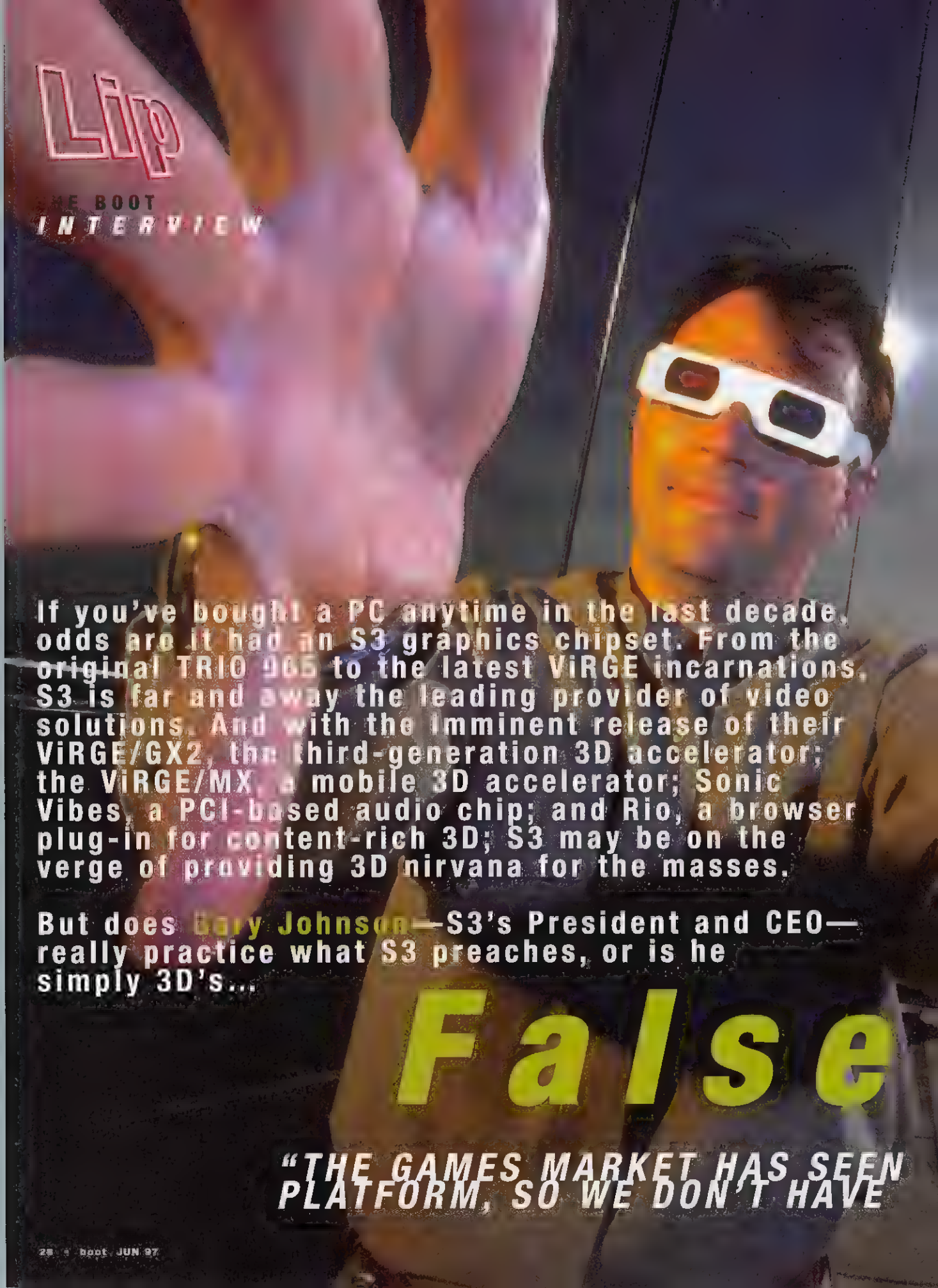
DOLBY SURROUND

Intel MMX™

Product Information Number 332

Lip

THE BOOT
INTERVIEW



If you've bought a PC anytime in the last decade, odds are it had an S3 graphics chipset. From the original TRIO 965 to the latest ViRGE incarnations, S3 is far and away the leading provider of video solutions. And with the imminent release of their ViRGE/GX2, the third-generation 3D accelerator; the ViRGE/MX, a mobile 3D accelerator; Sonic Vibes, a PCI-based audio chip; and Rio, a browser plug-in for content-rich 3D; S3 may be on the verge of providing 3D nirvana for the masses.

But does Gary Johnson—S3's President and CEO—really practice what S3 preaches, or is he simply 3D's...

False

"THE GAMES MARKET HAS SEEN PLATFORM, SO WE DON'T HAVE

What's the most brutal thing you ever heard [illegible] ViRGE look[illegible] prone?

Johnson: The frustration of users who [illegible] still the case. We [illegible] most visible part of silicon [illegible] terms of solving proble[illegible] dors in terms of [illegible] knowing the proble[illegible] it's you who must be screwing up.

Despite technological inferiorities compared to the 3Dfx and Rendition chipsets, S3 dominates the graphics chip scene. Why?

First off, I take exception to your saying [illegible] With an emerging market such as 3D, you have to have the right price/performance point to enter the mainstream market *and* deliver legacy solutions. We feel the price/performance point is right with ViRGE. At the same time, we fully integrate 2D and 3D and video, which those guys don't.

Even though ViRGE has captured the sweet spot of the market, we'll have at least two more variants hit the street next year, following the GX and DX, which have three times the performance of the previous generation. 3D still has a long way to go, and I'm not really concerned where ViRGE is starting.

How is S3 a technology leader?

Base 2D acceleration. The ViRGE GX2 announced in April will have [illegible] video performance you can get integrated in your graphics chipset.

3Dfx and NEC are spending millions to woo developers. Does S3 have to do that?

We did that in '96 to get the market seeded, and we'll continue to do that. The [illegible] ViRGE proliferate as the predominant platform, so we don't [illegible] to convince those guys anymore. Essentially, we give developers half the [illegible] for Q3. We shipped [illegible] million, and 6 million units, and next year it will be around 28 million [illegible]

Prophet?

ViRGE PROLIFERATE AS THE PREDOMINANT TO CONVINCE THOSE GUYS ANYMORE."

PHOTOGRAPHY BY MARK MADEO

boot ***What would you recommend for a gamer looking at 3D accelerator cards?***

Johnson I'd recommend the ViRGE GX or DX from Diamond or STB. I'd get them to look at the broad range of software support they're going to have for that card. I'd want them to look at future growth, who has the widest range of titles, and then look at who's going to give them 3D acceleration on the net. That's S3. And I think those are three pretty compelling reasons.

boot ***Do you think the ViRGE chipset is gaining respect among gamers?***

Johnson I believe it is. It's offering 3D to the mainstream gaming market. Is there an element of the market willing to buy two cards for ultimate performance? That's not where ViRGE is targeted today, but ViRGE gives 90 percent of the gaming market what it needs.

boot ***But in games such as* Decent II, *for instance, ViRGE cranks roughly 18fps to 20fps and 3Dfx runs at about 50fps. How important is frame rate?***

Johnson It's a combination. A stand-alone chip can give you infinitely high frame rates, but not at a price point the average user can afford. ViRGE is around $20 to $35; that's significantly different from the 3Dfx. The price/performance point for ViRGE makes it the best-selling mid- to high-end 3D accelerator. It performs well. It's consistent. There's still a lot of headroom, but the numbers speak for themselves in terms of what users think about the quality.

boot ***Do you think consumers buy systems based on the 3D technology or the overall system specs?***

Johnson Users always look for the CPU metrics; they always look for the number of megahertz it's running. But that doesn't translate to performance. I think graphics are becoming more important. The compelling part of a PC is multimedia. That's what motherboard suppliers use to differentiate their products.

A user walks into a store full of gray or blue or dark charcoal-colored plastic boxes with the same size screen, probably even the same motherboard, CPU, memory, and hard disk. What differentiates each is the quality of the multimedia system—the graphics, the audio, even the communications. The consumer's feeling about the machine is determined by the quality of the graphics. And 3D gives better realism, faster speed.

3D is just the first step. Combined with 3D, you need great video. And that's another thread of technology we've been developing.

boot ***By "video," do you mean the convergence of the PC and TV?***

Johnson There's no reason why the PC platform can't *exceed* the quality of TV. The monitor is higher quality with better pitch and better color brightness, and yet it's really hard for end users to sit down with a PC and still believe that it's supposed to be superior to the TV—it's not. It's hard to explain why a $3,000 PC shows video much worse than a $300 TV. It doesn't make any sense. We're solving that by bringing the best of the consumer electronics technologies into the PC space. Smaller niche companies understand how to take great quality and integrate it into the PC. That's what will make the PC better than anything in your living room.

boot ***With all the flavors of ViRGE chipsets, won't consumers get confused?***

Johnson I don't think so. Last year you could only get 3D on high-end home PCs. In '97 you'll see it on all home PCs, in notebooks, and also—toward the end of this year—you'll see it in the corporate marketplace. Again, most people look at us in disbelief and say, "How are you going to get 3D into the corporate world?" It's the same skepticism they had when we talked about ViRGE in November of '95.

"IT'S HARD TO EXPLAIN WHY A $3,000 PC SHOWS VIDEO MUCH WORSE THAN A $300

We'll use different price points and different performance points to open up new parts of the market. Today, business is the most important segment to S3, because 75 percent of the market is still corporate, and only 25 percent is the home. The ViRGE base is merging with new families. So you'll start to see ViRGE move into the mainstream 2D-plus-video market. I don't think that will be confusing.

boot ***What trade-offs does the ViRGE make?***

Johnson Performance—the processing of triangles per second. The balance we're looking at is overall picture quality vs. frame rate, and whether that's adequate for games. If you take some of the pure underlying mathematical trends, you can make comparisons with other chips. In the 3D games market, ViRGE's performance is adequate for the mainstream.

Frankly, I think the average consumer—not the gaming user, but someone like my wife or a non-techie PC user—expects to see *Toy Story* quality 3D. We call that "animation-level" 3D and the step

beyond that is "video 3D," or photorealism.

We recognize that there's a long way to go in these next two stages. Advanced lighting techniques and effects such as filtering over cycling for fine detail are going to take us there within the ViRGE family.

In terms of polygon processing, to get ViRGE to an animation level is about a 100-fold increase. To get to Video 3D is yet another 100-fold increase. So discussing where ViRGE is today in relation to the competition, the issue is, how do you get to *these* architectures vs. where you're at today? The architecture base we think is going to be important is the combination of ViRGE architecture with Microsoft's Talisman.

boot ***How does S3 feel about Microsoft moving into the 3D market?***

Johnson It's really great. Microsoft is looking to the year 2000 and trying to make sure Windows remains a compelling platform for 3D. They've put together a team and an approach. They have ready access to the technology and licenses. We like that a lot, and subsequent versions of ViRGE will implementing parts of Talisman architecture. The beauty of Talisman is that you don't have to do anything to get the benefits. So we'll take the best of Talisman and combine it into the ViRGE by the beginning of '98.

boot ***Do you think you have a good relationship with Microsoft?***

Johnson Yeah, I have a good relationship. It's the result of working with them at various levels, such as the engineering and the marketing. I think they see our value because of our position in the multimedia market. When they're looking at new models or new drivers, we work with them from early on to make sure they're making the right choices.

boot ***Do you think Microsoft has too much power in the industry?***

Johnson They certainly have a lot. Their intent of growing the PC business mimics the direction we've taken. Any initiatives that expand the industry are good for S3, so Intel and Microsoft continuing those trends is synergistic with us.

boot ***Do you view DirectX as the be-all and end-all of video drivers?***

Johnson That sounds like a leading question! No. It's only one more evolution of drivers. Driver models and architectures don't last forever, and there's no reason to assume that DirectX is going to last any longer than others. But that's what we have today, so that's what we work with.

boot ***Microsoft strips down the drivers included with the DirectX APIs, removing more robust features. What's your position on that?***

Johnson Our software designers and developers can always find ways to tweak and overcome particular APIs. Microsoft is trying to balance compatibility and stability, so they have a different chant than we do, which is to optimize the performance of one particular chip. They're trying to find a baseline platform.

They have a tough challenge, and part of that is a trade-off of performance for wider applicability. It's all about getting to that common denominator. Yeah, that does "de-feature" some of the capabilities. Then we work with Microsoft to convince them why those features should be included for things such as LPB [Local Peripheral Bus] architectures. Sometimes you need to work with Microsoft to convince them that "Yes, live video input is really key. You should include it."

boot ***Microsoft's Alex St. John said that it doesn't matter which 3D hardware you own, it's really about the driver support. Do you think that's true?***

Johnson Yes. While system performance is tied to both the hardware and the software, we invested early in our 3D Toolkit because Microsoft's APIs weren't ready. And the optimization of those drivers is getting closer and closer. We have a baseline model we supply to our add-in card vendors, who then provide their value-add. Then a second thread would be supplying those drivers with increased performance to the OEMs.

We allow the add-in card guys to differentiate themselves with their drivers and then we provide them—and the OEMs—with some hardware enhancements.

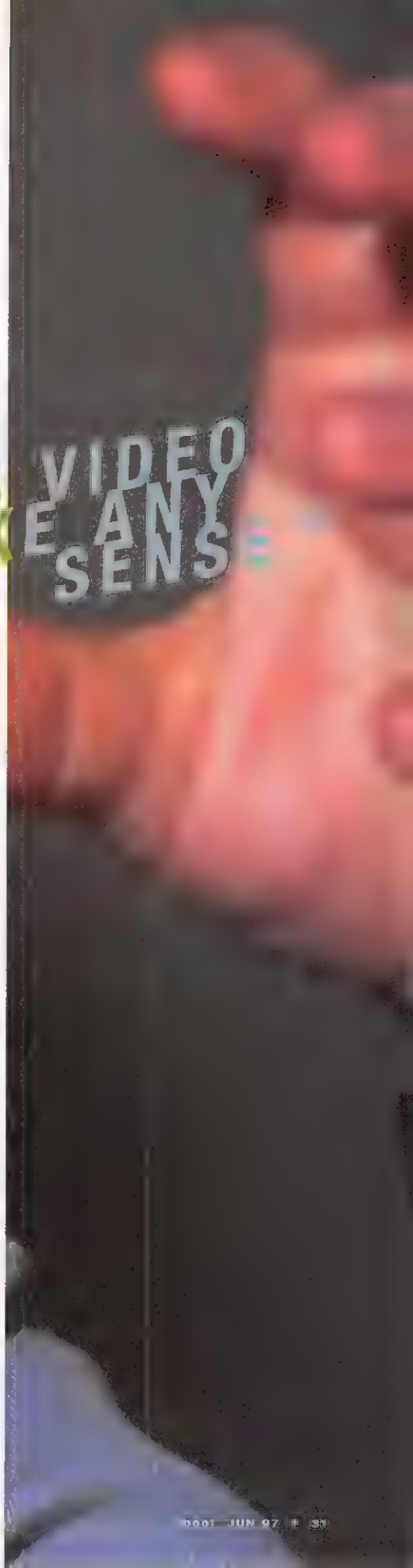
boot ***Many people say that the S3 drivers are superior to the drivers coming from OEMs such as Diamond and STB. Why is that?***

Johnson I haven't heard that. I think that add-in card suppliers *do* provide value. Those folks also supply the utilities that surround these drivers. It's a compliment that our drivers are well received, but I don't have the perception that our add-in card guys aren't adding value.

boot ***Rendition reportedly wants the motherboard market, an area S3 dominates. How will S3 defend their position?***

Johnson Gaming companies, such as Rendition, focus on a restricted few software

A $3,000 PC SHOWS VIDEO TV. IT DOESN'T MAKE ANY SENSE



titles. But designing for OEMs requires a lot of work apart from just the quality of the chip, such as software support. It's not just dropping the chip onto the board. It's providing all the driver support, BIOS support, and utility support.

Typically, motherboard vendors must support Windows 3.1, 95, NT, and OS/2—that takes a much broader software investment. Our software team has 350 accumulated man-years invested around ViRGE chips. That's really tough for a competitor to emulate.

boot ***Overall, are S3's OEM relationships good?***

Johnson Very positive. Apple is the only guy we're not working with, and in hindsight it probably wasn't a bad call.

boot ***Why?***

Johnson We've been focused on x86 and Windows, and the 3D graphics market is wide open—it's an almost half-billion-dollar business. I've no great desire to shift that focus.

boot ***Will Apple bounce back?***

Johnson I hope they do. I think most people hope they'll bounce back. It's hard to see an icon struggle as much as they're doing. But I don't see a clear public discussion of key strategies. I'd like to be positive, but I'm not sure I can be.

boot ***Sony chose the Rage 2 for their PCs. What are you doing to sell Sony and other OEMs on ViRGE?***

Johnson Part of that is working closely with OEMs to understand their true end-user application. For example, DVD is immensely important to Toshiba. So we ensure that our product road maps tie in and synchronize with what their driving markets are.

Having spot design wins is not really the challenge. The challenge is getting our road maps synchronized. Sometimes you can't do that. When you have nine of the world's Top Ten PC OEMs, sometimes you're in phase, sometimes you're out of phase. Work you do for a Compaq and an HP and a Dell may mean that in that cycle you can't synchronize with someone else.

boot ***Can S3 retain their leadership position?***

Johnson Yep. We have 36 to 39 percent of the overall market. In 3D, the number is 50 percent. Based on that market share, the knowledge that we have, and the derivatives of ViRGE coming out this year, I'm comfortable we can.

boot ***What about your competition?***

Johnson The one competitor that's done well, with about a third of our shipment size, is ATI. Other, smaller competitors have high marquee value, but, in terms of volume shipments, they are not there yet. It's a pretty crowded field. There are 38 companies with some form of 3D product. They'll carve out niches, but I think the dynamics won't change dramatically from '96.

boot ***Do you expect a shakeout in the 3D arena?***

Johnson It may take another year before it gets bloody. Startups have tried, and some startups will make a second attempt, but a third attempt is unlikely. Some of the big guys will probably hang in there a little longer. People will hang in there through '97, but in '98 you'll see a lot of people fall out.

boot ***Of all S3's competitors, is there one that you admire?***

Johnson "Admiration" is probably too strong a word. We're in the bull's-eye and the other guys are aiming at us. There are companies that I think have shown the way and deserve some credit for pioneering new technologies, such as NeoMagic, who pioneered the concept of integrated DRAM. I think that kind of innovation and approach is healthy for the industry. It's tough for them in the long haul, but I think companies such as NeoMagic live up to what's best about Silicon Valley, taking a new technology and a new idea, and forcing them into your market space.

boot ***What does S3 foresee as the most significant change to display technology during the next few years?***

Johnson When displays can hang on a wall—either the plasma technology or TFTs in two-and-a-half inches of space, 32-inch panels with less than two defects per screen—that will be a major breakthrough.

We have a unique technology called Duoview that can power two types of displays from a single chip, a TV or an LCD, at different refresh rates and different resolutions. In the gaming world, you could have displayed the full game on your TV, and on a side LCD panel you can have the control panel—and that's out of a single chip.

boot ***Does 3D belong on your lap?***

Johnson Yes, and some of the major OEMs in the high-end platforms agree. They're looking for ways to bring gaming and new capabilities this year. Also, TFT panels have the speed to really move and look good. With DSTN panels you wouldn't get that shadowing.

boot ***When do you see AGP becoming important?***

Johnson AGP provides yet one more way of boosting 3D performance, so AGP will be key to all of our future products. It's not a radical approach; it's incremental, building on PCI to give a 4x performance increase. But it's just one of the initial steps. So, AGP is perhaps a little behind. In fact, the April product will be AGP-enabled. But it's really just the start of what's needed in terms of new architectures. The question will be whether AGP is supported by all the operating systems. And that's why AGP may well be quite late this year in terms of getting everything from Microsoft.

boot ***PowerVR is a radically different architecture and the latest rev adds filtering to fast frame rates. Does S3 have any new tricks up their sleeve to compete with that?***

Johnson Integrated DRAM. As soon as you go off-chip the whole dynamic of memory interfaces changes. We've been investing in internal DRAM heavily now for 18 months, dramatically increasing bus access with literally the same die as the frame buffer of other types of memory. That gives you significant performance boosts, which is probably more significant in terms of external memory just because of the timing and contention issue.

boot ***Fast memory is the key to better 3D performance. What do you think about Rambus technologies?***

Johnson We started working with RAM bus early on. Looking at the trade offs in '97, our feedback from the OEMs and the market players was to use asynchronous memories, in terms of both performance and price point. Maybe RAM bus does kick into the '98-'99 time frame, but for '97, 100MHz SGRAM will be the performance memory of choice.

boot ***AMD failed with the Interwave chip. How will S3 do things differently with the Sonic Vibes audio chip?***

Johnson We're making sure we tie in initiatives, particularly to Microsoft, such as DirectMusic support, and using that as a key differentiator in bringing that technology to the market. The product is being well received by both the OEMs and the add-in card guys. Those deals will be announced in November. We'll see how the market responds to the transition from ISA-based audio, which has been there for 15 years, to the PCI bus. We think it will be positive.

boot ***Creative Labs has said that it's impossible to guarantee Sound Blaster compatibility or legacy support on the PCI bus.***

"IS THERE AN ELEMENT OF THE CARDS FOR ULTIMATE PERFORM ViRGE IS TARGETED TODAY."

Johnson We believe we've done that. I'm willing to state that to the best of our knowledge and with all the testing we've done, the aim is to make it compatible and we believe it is.

boot ***How important do you think multiplayer or online gaming is?***

Johnson I'm not a multiplayer gamer, but I think it's starting to become much more immersive with some of the 3D work going on. The technology is catching up to what the hardcore gamers would like. Initiatives,

MARKET WILLING TO BUY TWO ANCE? THAT'S NOT WHERE

such as our Rio Initiative, should have at least 5x performance increase in terms of the 3D realism. Those sorts of initiatives will make 3D gaming really capable in my mind, probably for the first time.

Pioneers will use services such as TEN and Mplayer, but to expand you have to make it easy to use and more compelling. It needs that performance aspect to make it compelling. Today, anything connected to your modem line is pure software and still just bits per second.

boot ***What's the Rio initiative about?***

Johnson When you're downloading 3D worlds, all that time is spent downloading textures. But richer texture sets can be stored on the hard disk with less than 1MB of data of standardized textures. When people then start sending instructions down from the net in terms of building these worlds, they first look to the disk and see if the Rio texture is there; if not, they'll download it. But the speed difference of not having to download textures time and again is pretty dramatic. So we've created a wide range of texture sets that really speed up the ability to recreate 3D worlds.

boot ***Is there one game that doesn't support ViRGE that you would love to have support it?***

Johnson Me personally? No, because I'm not a hardcore gamer.

boot ***You're not a gamer?***

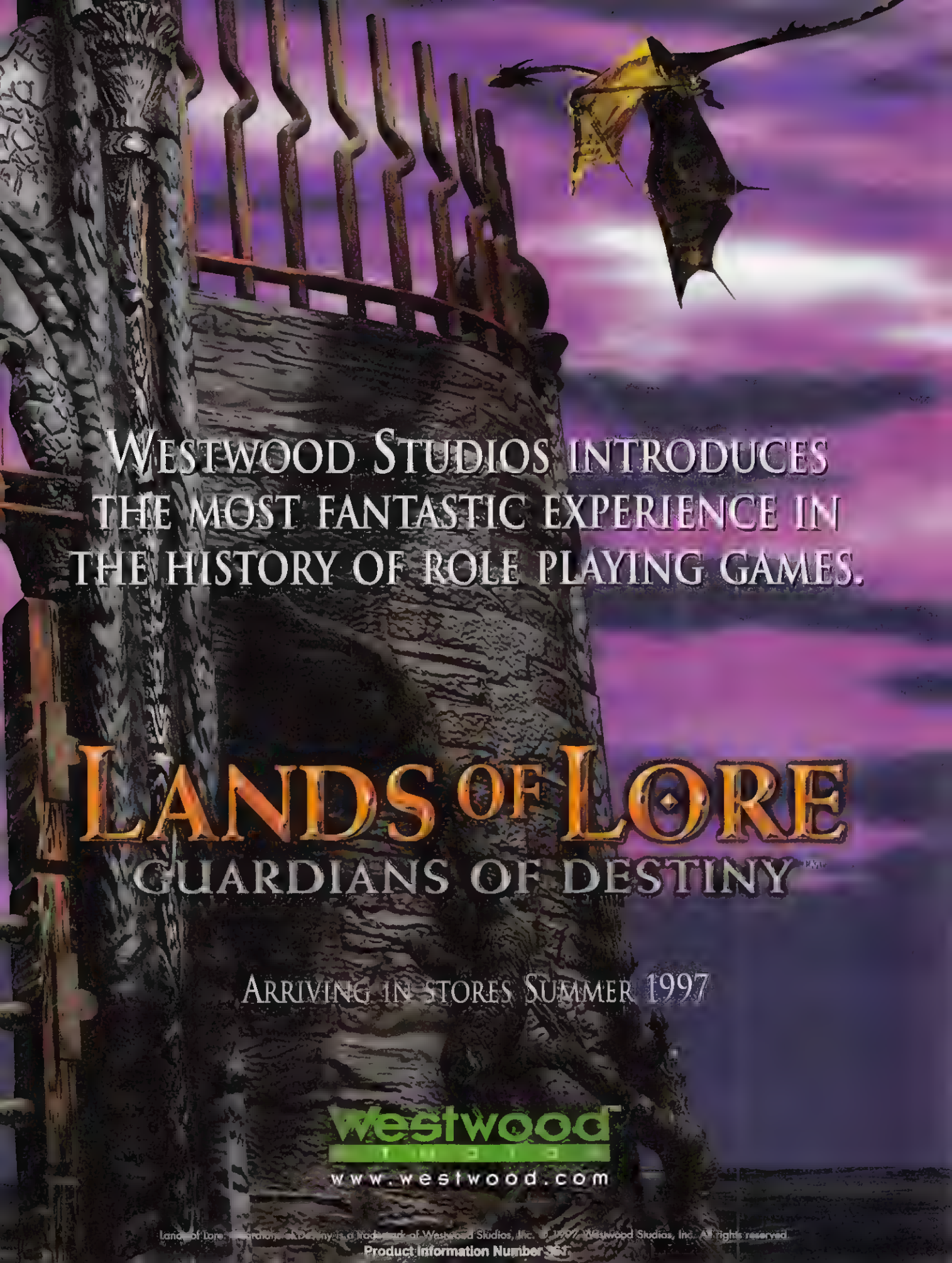
Johnson My son is a bigger gamer than I am. I brought some 200MHz HP Pavilions home with ViRGE and *Descent II* and *VR Soccer.*

boot ***You must get a good deal on HPs...***

Johnson No, actually I bought them from Computer City.

boot ***Do you only play ViRGE-supported games?***

Johnson I really don't play the action games my kids are involved with. What I do to push the quality and performance level is to go to trade shows and get out there on the floor and go to competitors' booths and understand what they're doing.



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Product Information Number 361

DESPERATELY SEEKING CPU

Single Black CPU seeks hot and bothered technophile for gratuitous Slot 1 filling. Must exceed 200MHz, enjoy long nights pumping pixels in NT and the occasional fragfest. Backward compatibility a BIG turn-on. **MMX required**. No smokers please.

Meet the PENTIUM

You down with SEC? Yeah, you know me!

*There's a **svelte and sexy** new Pentium in town, promising to trash all previous **speed** records. **boot** gets hands-on and guides you through this new **CPU seduction**.*

THE HYPE: A change is a-comin'

Back when you first contemplated the big jump from your graying Pentium 166 to the realm of an NT-powered Pentium Pro running at 200MHz, you heard the rumors. A new Pentium Pro-based CPU code named Klamath would harness MMX—the 57 instruction sets that unleash apps, allowing them to perform PC miracles.

Sure, it would be the new kid in town, but it would have some serious sex appeal. But then, when you were in the throes, you heard about the new CPU interface, one that would change the PC processor landscape forever.

You decided to wait.

It's now May 1997. MMX is ramping up to take the PC community for a fast and furious ride. The Pentium 200 with MMX is *boot*'s baseline system for desktop benchmarking, and developers everywhere are lining up to take it out for a spin.

Now Intel's finally unleashed the successor to their number-one number-cruncher—the Pentium Pro—this time armed with MMX. It's the Pentium II, and it's strutting its bad self in a high-powered workstation near you. But when will it make the big time and become standard equipment on home desktops?

When asked how soon the market will standardize the PII, Reality Bytes' Jason Davis takes an aggressive stance: "By Christmas '98 we'll be strongly suggesting a PII/AGP/3D Accelerator system." But he adds, "I think we'll be supporting original Pentium MMX systems (with accelerators) in that season as well. Once 1999 is under way I think having a pre-PII/AGP system will be like having a 486 is now; you can still play some of the newer games, but not the cool ones!"

"The Pentium II will move into the mainstream really quickly," claims David Farmer, director of PC Products at Intergraph. "We see the PII being targeted at the power user; CAD folks and power gamers who want the max!" Farmer is optimistic about the mass availability of the PII. "Expect to see PII systems in full-force toward the end of the year... right around Christmas."

"Our next-generation game engine's targeted at PII and a good 3D accelerator for full impact" boasts id Software's John Carmack. "It will run OK on lesser hardware, but that's what it is going to be designed for."

THE CPU: Plug It In

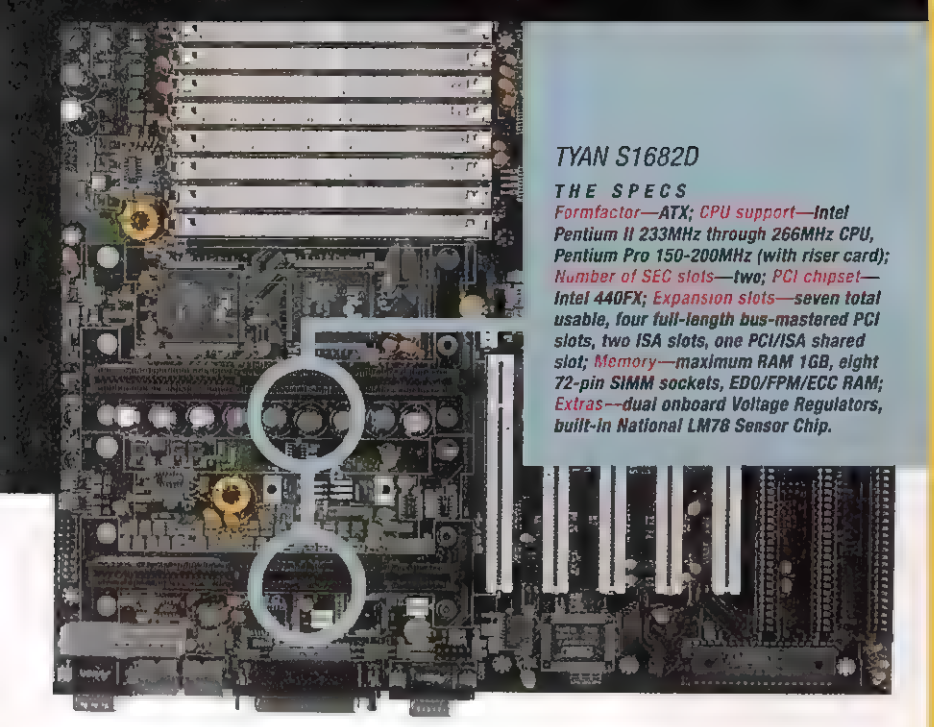
From across the room you notice a fresh new face. There's something familiar about the form, something distinctly... Nintendo-esque. You've heard all the rumors and they've proven true. This sexy new CPU has abandoned the traditional pin-grid array for the game-cartridge-inspired Single Edge Contact (SEC) design.

Closer inspection reveals that the metal plate on one side of this naked CPU is littered with *pg 38 >*

BY ANDREW SANCHEZ

photograph by Aaron Lauer

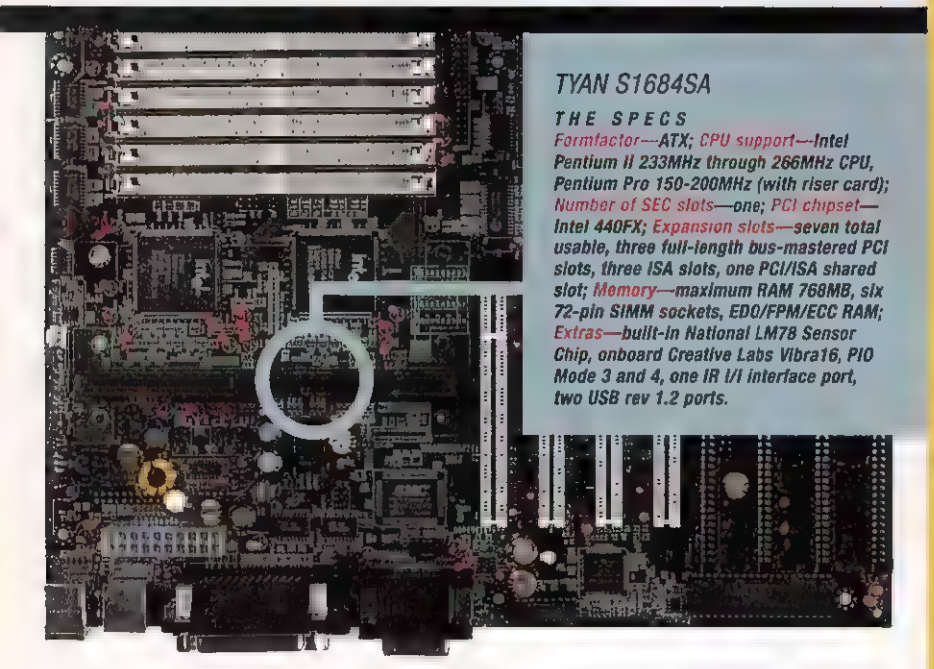
"Our next-generation game engine's targeted at PII and a good 3D accelerator for full impact." ***—John Carmack of id***



TYAN S1682D

THE SPECS

Formfactor—ATX; CPU support—Intel Pentium II 233MHz through 266MHz CPU, Pentium Pro 150-200MHz (with riser card); Number of SEC slots—two; PCI chipset—Intel 440FX; Expansion slots—seven total usable, four full-length bus-mastered PCI slots, two ISA slots, one PCI/ISA shared slot; Memory—maximum RAM 1GB, eight 72-pin SIMM sockets, EDO/FPM/ECC RAM; Extras—dual onboard Voltage Regulators, built-in National LM78 Sensor Chip.



TYAN S1684SA

THE SPECS

Formfactor—ATX; CPU support—Intel Pentium II 233MHz through 266MHz CPU, Pentium Pro 150-200MHz (with riser card); Number of SEC slots—one; PCI chipset—Intel 440FX; Expansion slots—seven total usable, three full-length bus-mastered PCI slots, three ISA slots, one PCI/ISA shared slot; Memory—maximum RAM 768MB, six 72-pin SIMM sockets, EDO/FPM/ECC RAM; Extras—built-in National LM78 Sensor Chip, onboard Creative Labs Vibra16, PIO Mode 3 and 4, one IR I/I interface port, two USB rev 1.2 ports.

PORTRAIT OF FIRST-GENERATION SEC MOTHERBOARDS

Tyan's next-generation SEC motherboards should be available by the time you read this. Sporting single and dual SEC designs (something Intel has yet to develop), Tyan's immediate availability of a dual PII motherboard design has made them the industry darling, with major NT workstation manufacturers knocking on their door begging for motherboards.

All your favorite motherboard manufacturers including ASUSTek, Micronics, AIR, Intel, SuperMicro, and Octek are gearing up to lock horns in the hotly contested motherboard market, so start saving for that rainy day, because a motherboard storm's definitely brewin'!

holes. This is where the massive heat sink will be attached. A variety of cooling solutions are in the works, but one thing's for sure—Georgia asphalt has nothing on the Pentium II.

Sneak a peek inside and you're greeted by 7.5 million transistors. These make up the heart and soul of the 203x203mm die-size CPU mounted on the SEC IC board. With 32K of internal L1 cache and the full MMX instruction set onboard, the external PBRAM L2 cache flanks the CPU. Moving the 256K or 512K off the CPU, the L2 cache bus runs at half the CPU speed—unlike the Pentium Pro's tightly coupled L2, which runs at CPU speed. Intel figures that dedicated memory manufacturers are better suited to design cache than they are, and that not having L2 integrated into the CPU will be more efficient. But with applications which rely heavily on faster L2 cache and aren't MMX savvy, your 200MHz Pentium Pro will actually outperform the 233MHz Pentium II.

However, Intel isn't phased by this, insisting it's all part of their all-encompassing plan to break system bottlenecks. In fact, they plan to introduce their Dual Independent Bus (DIB) architecture with the PII. In a nutshell, DIB streamlines the processor-to-main-memory bus and the L2 cache bus. Intel claims that the dedicated L2 cache on a PII operates at twice the speed of a Pentium's L2. Unfortunately, that's not saying too much in light of the P-Pro's current performance. But, Intel's pipelined system bus allows simultaneous parallel processing rather than singular sequential processing. Toss in AGP, and your system is ready for the eventual arrival of 100MHz parts.

If you're worried about speed with legacy 16-bit applications, segmented register caches within PII make minor amends for the poor 16-bit and 16/32-bit support plaguing the P-Pro. You'll just have to settle for 233MHz, 266MHz, and 300MHz for the first round of PIIs. Darn. (But we've seen these bad boys overclocked up to 450MHz at a recent show—with a little help from some massive liquid cooling!).

JUMPER JOCKEYS REJOICE: Turning up the heat

The Pentium II is exceptionally overclocker friendly. All PIIs safely run at one speed higher than their intended rate—a 233MHz can be overclocked to 266MHz, a 266MHz boosted to 300MHz, and so on—with the proper cooling. But, given the thermals the PII pumps, "proper cooling" may involve Prestone. Manufacturers probably won't note this potential in their manuals, but some motherboards will support up to a whopping 500MHz.

Adding to the heat problems is the new CPU's size. "The processor cartridge has its own contained airspace," says Farmer. "It's not a cool part. You should stay away from small fans—they're more prone to fail." He recommends using burly heat sinks and some carefully designed interior air circulation. "You need to have good air flow over the part and

must get that heat out of the box."

Massive heat sinks are added weight. Vendors implementing the PII must be prepared to strap the CPU down to the motherboard and fasten the heat sink so it doesn't force the CPU to lean.

For all its overclocking prowess, the PII is still shackled to a paltry 33MHz PCI bus, and a 66MHz memory bus with the current 440FX PCIset. Later chipsets will break free of the 66MHz bus limitation and by that time Intel's AGP should be moving into your favorite motherboards.

THE PERFORMANCE ISSUE: The need for speed

When the first Pentium II system strutted into the bootLab, every editor had their copies of *Quake*, *3D Studio Max*, *MDK*, and *Photoshop* in hand, itching to take this baby out for a nice, long ride. Hell, we even slapped in Rendition's Vérité V1000 reference board and Diamond's Monster-3D for some intense polygon pumping.

So, does the PII live up to the hype?

If you're looking for hot and heavy rendering, the PII's sure to please. Compared to other single Pentium Pro stations, the PII slashes through render times, saving up to five minutes per frame. With the right video card, OpenGL performance also soars, with Viewperf's CDRS posting stellar frame rates.

When it comes to legacy software, the PII shows some speed increase, but it's not nearly as dramatic as we'd like. *GLQuake* performed as expected, posting almost 29fps in our tests (great, but we've seen regular P200MMX machines armed with 3Dfx cards post the same numbers). Rendition's VQuake spewed similar results, while *MDK* posted a slightly lower score when compared to Shiny's benchmark P-Pro 200 rating. 3Dfx/MMX *Pod*, however, had us stoked. Easily racing past 60fps, *Pod* on a PII destroys arcade-racing sims such as Sega's *Daytona USA*. After all, when's the last time you saw bilinear filtering in an AM2-powered machine?

If an application is MMX-ready, such as *DeBabelizer Pro*, you'll have a lot less time to burn on the can when you throw a Super-Palette into an AVI file—we've seen processing times literally cut in half.

Like its P55C sibling, the PII will suffer until more MMX-specific titles are unleashed. But with developer support, this situation will quickly improve.

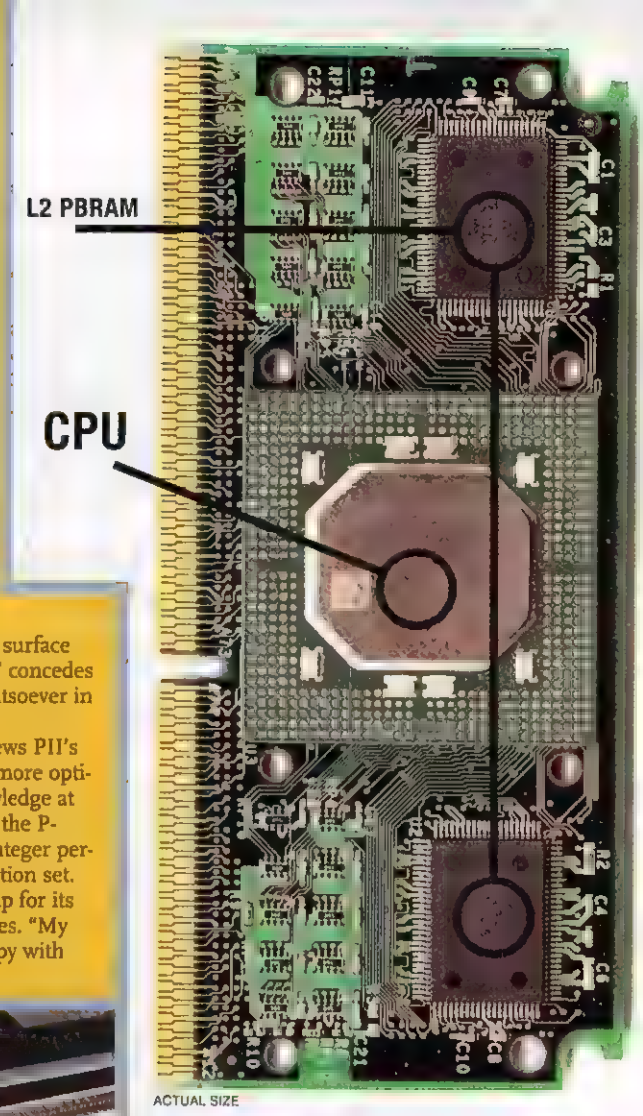
THE WORLD BUILDERS: Developer scale the heights of PII

Developers must forge new realities for a faster world. Reality Bytes' Davis is turned on by the PII's bright prospects for 24-bit rendering under MMX. "Once AGP comes along I'd expect a PII with AGP and a good 3D accelerator card to be the next system baseline [such as Pentium vs. 486 was a few years ago]. The PII can do great things with sound and video, plus it enables faster 3D computation and 24-bit rendering."

"The PII's performance is comparable to the P-Pro," states id's Carmack. But he offers dire warnings, as well. "Other apps may see greater performance increases, but *Quake* is so memory-subsystem intensive that the removal of the on-chip cache may hurt us."

Will id make the big jump to MMX? "It may find a place in surface generation for the next product," concedes Carmack, but "it has no use whatsoever in *Quake*."

Digital Anvil's John Miles views PII's world-creating capabilities with more optimism. "It's fairly common knowledge at this point that the PII combines the P-Pro's excellent FPU and 32-bit integer performance with the MMX instruction set. Upping the clock speed makes up for its less efficient L2 cache," says Miles. "My guess is that gamers will be happy with the PII, especially once the clock rates rise a little more."



ACTUAL SIZE

Above: The Pentium II CPU, in all its naked glory. Left: No ZIF for you! This SEC connector is your ticket to MMX-induced P-Pro pleasure.

But new technology never comes without a warning. "As with any new processor, I certainly wouldn't buy the first one out of the fab, because obviously the clock rates are going to go up rapidly as the yields improve."

Other concerns also plague would-be Pentium II developers. Miles has reservations about the newer Intel chips, the PII in particular. "Rumor has it that Intel still hasn't addressed the issue of enabling PCI write-combining for the display card's linear frame buffer under Win95. This means *FASTVID*, or a similar P6 utility, will still be needed to get acceptable graphics performance from systems based on the PII. If true—and I can't confirm either way just yet, because I haven't tested it—this is a real disappointment. Intel's continuing failure to address this critical (and trivial-to-fix) performance issue is dumbfounding to say the least."

Miles also has concerns about other major chip manufacturers. "Intel's competition is getting faster and cheaper every day. For instance, AMD is coming on extremely strong with their K6 processor as a competitor for gamers' mindshare and market share. The current K6 isn't the best processor for running FPU-intensive games such as *Quake*, but for 95 percent of everything else on the shelf, it will probably be at least reasonably competitive with the PII's performance. And at a price point that's far lower than the PII's, and lower than the standard P5-MMX 200MHz processors which it outperforms in many ways," says Miles. "Not since the days of the 286 has Intel allowed its competitors to come this close to the performance of their flagship products. It's certainly good news for the consumer!"

Compared to Carmack's strong-arm position of breaking performance *pg 41 >*

THE PENTIUM PRO PCIset

Before stomping down to the local Motherboards-R-Us, get the facts on all of the latest PCIsets from Intel.

440FX—Intel's Pentium Pro PCIset. While it can handle up to 2GB of system RAM, you'd need 16 SIMM sockets on your motherboard to cope with such monstrous memory, so 1GB is a more realistic limit in terms of total RAM. The 440FX supports dual CPUs, and USB, but will eventually fall by the wayside for newer technologies.

440LX—Coming soon to a motherboard near you. Aside from the cool flavorful fixings that the 440FX offers, the single biggest addition is the support of Intel's AGP spec, so hardcore 3D graphics monkeys can get their fix of high-speed pixel pushing—provided you have your AGP video card ready. Expect all major video-card manufacturers, including Matrox , ATI, and Rendition to release AGP-based boards.

440BX—Down the line in Intel's PCIset path and eventual successor to the 440LX, the 440BX is designed for the next-generation CPU. One of Intel's first PCIsets to break the 66MHz barrier, the 440BX will handle 100MHz Slot 1-compliant CPUs, as well as single or dual CPU's running at 300MHz. L2 cache may increase to 1MB or 2MB.

450NX—The gateway to quad-processor prowess. Not much is known about the 450NX at this point, but expect it to add a few surprises to everything the 440BX sports.

INTERGRAPH TD-225

HARBINGER OF HIGHER PERFORMANCE

A peek under the Intergraph TD-225's hood reveals the awesome number-crunching potential that is the Pentium II.

While this model is still in beta form and some of the components are subject to change, we confronted the PII with our brutal new suite of bootMarks *and showed no mercy.*

Yanking the beige cover off is an uneventful affair thanks to the handy screw-knobs. The haphazard layout of ribbon cables and power connectors are evidence of the TD-225's beta status, but hack past the electronic foliage and you'll be rewarded.

Twin PII 266MHz CPUs armed with gargantuan extruded heat sinks dominate the electronic landscape. Eight SIMM slots let you add up to 512MB of system RAM—64MB ships with the unit. Unfortunately, the CPU/heat sink combo's bulkiness forces the SIMM slots to the edge of the motherboard, and two slots are unreachable without removing the hard drive cage.

With so much processing going on, the temperature near the CPUs reaches sweatshop levels. Thankfully, Tyan's S1686 ATX formfactor motherboard positions those rascals near the power supply, providing much-needed cooling action—although the first CPU hogs the fan. But what good is a single fan if all it does is circulate hot air? A second air fan positioned at the front base of the case sucks superheated air out of the case.

Intergraph's own 16MB Intense 3D Pro1000 video card satisfies all your OpenGL needs, while Fujitsu's MPA3052 S.M.A.R.T EIDE hard drive takes care of storage. Toshiba's XM-5702B 12x EIDE CD-ROM drive (reviewed in boot *05) rounds out the storage duties. After all this action, one 5.25-inch bay and two 3.5-inch bays remain free. While the video card uses one PCI slot, another is rendered useless by the retrofitted twin USB connectors. Intergraph plans to move the USB ports.*

If you're thinking of running Win95 with the Intense 3D Pro 1000-T, you'll have to settle for the generic Cirrus Logic CL-5430 device drivers. The core Cirrus Logic VGA chipset inside the Intense 3D 1000-T limits you to 800x600 at 256 colors. Intergraph's feverishly working on drivers, so stay tuned.

When the pedal hits the metal, this system posts some serious benchmarking scores. Viewperf's CDRS test, which tests single CPU and OpenGL performance, blasted in at a whopping 27.5fps. Compaq's Professional Workstation 5000, armed with ELSA's GLoria-L 3D adapter petered out at 12.2fps. With Viewperf's multiple CPU-intensive DRV-04 benchmark, the TD-225 muscled in 4.71fps, while the Workstation 5000 squeezed in 1.66fps. The TD-225 is no slouch with everyday WinNT applications, posting a SYSmark for WinNT 4.0 official score of 217—far greater than the 159 the Compaq machine managed. Despite its beta nature, the hard drive and CD-ROM subsystems performed admirably, and overall real-world performance was exceptional.

With some solid performance, dual PII processors, and room to grow, the Intergraph TD-200 is a monster of a rendering machine.

— Andrew Sanchez

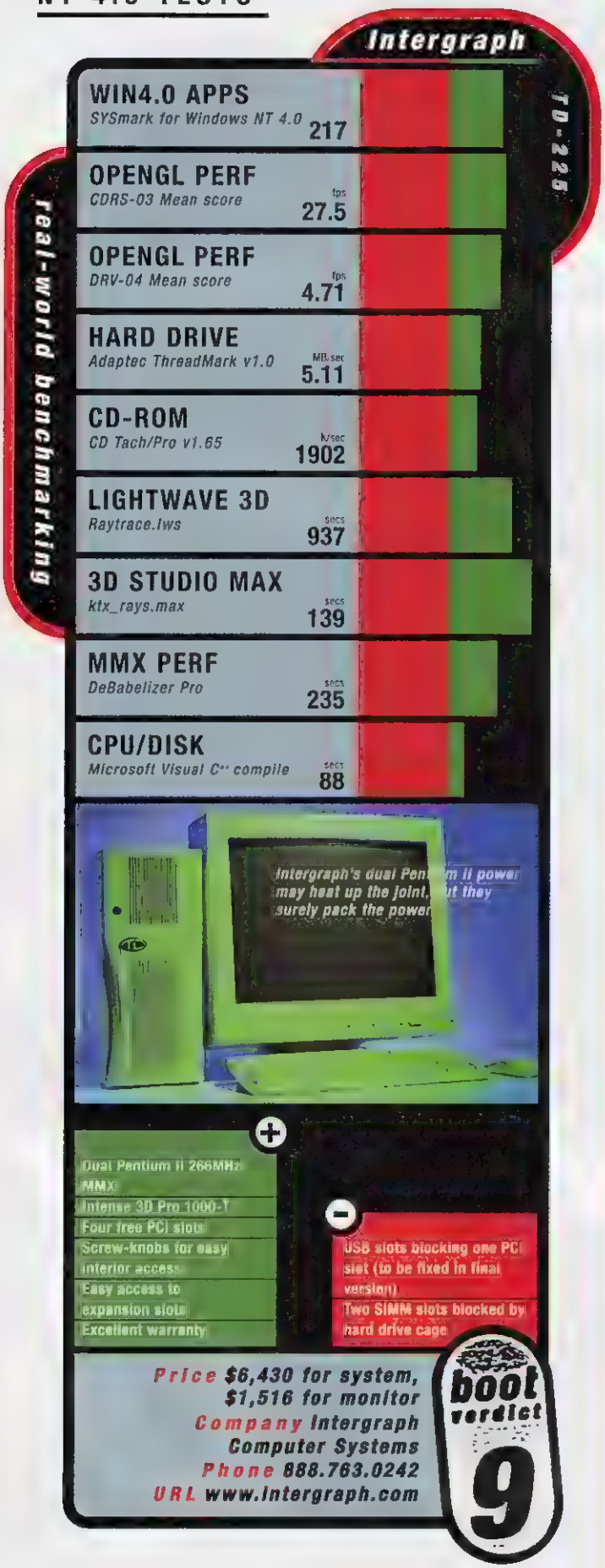
under the hood

THE BRAINS	
CPU	Intel Pentium II 266MHz (two)
L2 Cache	512K PBRAM secondary
RAM	64MB EDO-DRAM (512 MB max)
Motherboard	Tyan S1682 ATX
THE BRAWN	
Video	Intergraph Intense 3D 1000 with 16MB SDRAM (4MB texture option). Cirrus Logic core VGA chipset
Hard Drive	Fujitsu MPA3052 EIDE
CD-ROM	Toshiba XM-5702B 12x CD-ROM
Expansion	Four full-length PCI slots (one occupied), two full length ISA slots, one full-length PCI/ISA shared slot
I/O Ports	Two USB ports, two serial ports, one parallel port
THE BEAUTY	
Display	Intergraph 21SD95 21-inch multi-sync monitor, 1280x1024 maximum resolution with 16 million colors @ 75Hz.
Sound Card	Optional
Speakers	Optional

THE BUNDLE Windows NT 4.0

boot :65 down :7

NT 4.0 TESTS



envelopes, Miles takes a more cautious approach to predicting the PII as the new gaming standard. "I don't anticipate this happening at all. We're only concerned with performance, not the brand name stamped on the chip package. Until recently, it didn't make sense for us to pay attention to any players except Intel, because what the competition had to offer was basically a joke when it came to high-performance gaming applications," says Miles. "I think the question could be phrased more accurately as, 'Will specific features such as MMX be mandated by developers any time soon?' Again, the answer would be 'no', simply because of the plethora of alternatives (3D hardware, faster FPUs, etc.) available to consumers nowadays. Intel has some great stuff to offer, and so do other vendors. Our job is to help consumers enjoy the new technology to the greatest extent possible."

As far as using MMX with their products, Digital Anvil is far more receptive. "Absolutely," says Miles. "MMX offers some valuable incremental advantages. It doesn't allow us to do anything we couldn't have done anyway, but we can certainly take advantage of the extra performance available for certain types of operations."

THE MOTHERBOARDS: Slipping into something sexy

Getting motherboards to mate with SEC isn't as easy as you'd think. According to Tyan's Adam Vener, it's actually quite a challenge. "It was very hard, both mechanically and electronically, considering that the slot is harder to place on the board, and the fact that it has to be placed near the VRM components, the chipset, and the CPU has to be aligned properly to be cooled by the ATX power supply," says Vener.

Once you get past these challenges, you're still left with an atrocious power hog in the form of MMX, sucking down over 15 to 20 percent more juice than previous P-Pros. Throw in these thermal considerations and you have the makings of hot times in the tower case *every* night.

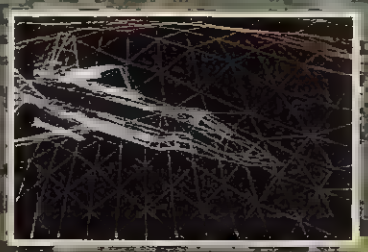
While many manufacturers will initially release both AT and ATX formfactor motherboards, go with the ATX formfactor whose power supply pushes air directly onto the CPU, or with newer NLX formfactors. And, beyond deciding between single or dual CPU design, ensure your new motherboard comes armed with the LM78 Sensor chip. With the proper server-level OS (WinNT, etc.), you can check the CPU's temperature, as well as have a 24-hour watchman keeping tabs on your CPUs voltage and their cooling fans.

The biggest hurdle in your quest to get Klamath-ized might be the general lack of CPUs available. Indeed, the majority of motherboard companies ready for PII's release in mid-May will have motherboards ready. But, according to Intel, due to the complexity of the CPU mounting, installation, and cooling, they won't even have parts available to sell in distribution channels until the third quarter of 1997. The available CPUs are going to the vendors, (i.e., Intergraph, Hewlett-Packard, etc.) who can, in Intel's opinion, "utilize them best."

So, what if you already have a P-Pro and a shiny new SEC motherboard but the local techno-dweebs don't have any PIIs for sale? Try a P-Pro riser card on for size. Most manufacturers will have this Slot 1 daughtercard with a ZIF socket mounted onto it. Plug in your regular, non-MMX enhanced P-Pro and render away the days while you await your new CPU.

BENEATH THE SHINY PAINT JOBS AND SMOOTH LINES OF TODAY'S HOTTEST 3D GAMES BEATS A HARDCORE HEART—THE MIGHTY GAME ENGINE THAT DETERMINES WHETHER YOU'RE PLAYING A FERRARI OR A YUGO.
Today's Technology Tweaked for
Revvin
3D

3D ENGINES



Tomorrow's Games

g U p

E n g i

BY T. LIAM McDONALD

3D GAMES ARE A WINDOW INTO ANOTHER WORLD.

Immersive realities, whose impact is linked to how effectively a small cadre of coders does their jobs. Jostling for their attention are technologies such as MMX, 3D accelerator cards, digital elevation models, micro-texturing, portals, and binary space partitioning; and issues such as OpenGL vs. Direct3D and Microsoft vs. SGI.

All of this boils down to the game engine that rumbles underneath the polished sheen of the final game. This is the critical domain of the arcane code wizards who create the skeletal engine that either makes or breaks a game.

There are many engines in circulation, each attempting to top the other with technology that looks better, renders faster, and allows more interesting and interactive environments. A pecking order exists among these: outdated oldies that still manage to get intermittent play, yesterday and today's technology that still has a few more miles left in it, and the cutting-edge engines of tomorrow.

While usually designed for a specific title, these engines must pull a lot of extra duty to break even. The investment in time and money to create new technology is high and, as a result, repurposing runs rampant. For evidence, you need look no further than the top of the sales charts. 3D Realms' *Duke Nukem 3D* BUILD engine hums beneath the hoods of *Blood*, *Redneck Rampage*, *Shadow Warrior*, and *PowerSlave*. The *Descent II* engine created by Parallax is being used for the Advanced Dungeons and Dragons RPG *Descent to Undermountain*.

MechWarrior 2's technology fueled *Mercenaries* and certainly inspired *Interstate 76*. Bethesda Softworks' XnGINE provides the polygon pushing for *Terminator: Future Shock* and *SkyNet*, *Daggerfall*, *X-Car*, and *The 10th Planet*. The same first-person terrain generator that powered Bullfrog's *Magic Carpet* can be seen in the *Netherworlds* sequel and bits and pieces of it are even visible in *Syndicate Wars* and *Gene Wars*. Too bad *Creation* was canceled—that would have taken the engine to new heights.

Quake's technology was so impressive when originally created that it still had plenty of juice to fuel *Quake II* and, more interestingly, *Hexen II*. (Id Software refugee John Romero's new startup, Ion Storm, should be kicking out some compelling stuff, but their first 3D-action properties, *Daikatana* and *Anachronox*, aren't built on new technology, but will be based on the tried-and-true *Quake* engine. Core's *Tomb Raider* made a big splash, despite clipping problems, and should be in for the long haul because of solid 3D-card support.

Beyond the action genre, there is the "other" realm of virtual environment rendering: the flight sim. Two companies making a lot out of their new core technology are NovaLogic and Interactive

Magic, who offer VoxelSpace II and DEMON-I respectively.

Other new engines show distinct promise as well. Beyond Games has excellent distance-rendering techniques in their *Redline* racing game. *Pod*, *MDK*, *Chasm*, *EarthSiege 3*, *In the Flesh*, and *The Condemned* might become standards. One thing is for sure: The future is getting sharper every day.

BLIT THIS

The fastest pixel is the one that is never rendered. Thus goes the programmer's adage. Speed is the issue: Incredibly realistic worlds can be created, but the challenge is getting them to render quickly on the average PC. Hardware advancements, ranging from faster processors to new technology such as MMX and 3D accelerator cards, are edging designers ever-closer to on-the-fly photorealism. The programmer's palette of techniques is wildly expanding. Nowhere is this more evident than in the shift to "portal based" rendering, in such impending titles as *Prey* and *The Dark Project*.

To understand what makes this a step forward you need to know how a renderer goes about its business. A virtual environment in a 3D game comprises data representing the basic **geometry** of the world (walls, ceilings, objects). When rendering, the first step is to **subdivide** this dataset, which quickly eliminates unseen elements while sorting and prioritizing visible elements. One technique uses **quadtrees**, which divides the scene into four quadrants and divides each quadrant again, until you reach the proper resolution.

This is the technique behind the new *Flight Unlimited II* engine, a wonder of programming devised by James Fleming. "The trick is drawing just the right-size tiles within that hierarchy at the right distance to fool the eye into believing it's real," says Joe Gilby, tech director of Looking Glass. "The big technology advance for *Flight II* is the size of the dataset—more than 8,500 square miles of high-resolution terrain data. Managing that amount of data in real time to the same resolution as the 5 square miles for the original *Flight Unlimited* has been enabled through sophisticated threading, compression, and cache-management technology."

Quadtrees work well for outdoor renderers, but for indoor games and stand-alone models the common modus operandi is **binary space partitioning (BSP)** and **Z-buffering**. The Z-buffer compares and tracks the distance to the eye of all objects from a particular pixel, with the closest objects being rendered. This means the software is always running a comparison against the buffer, which can cause a huge processor drag as many pixels are drawn only to be rewritten with something closer. The Z-buffer memory cost is traditionally 16-bits or 24-bits times the screen resolution.

BSP looks at each polygon in the model and determines its relationship to every other polygon (i.e., is it in front or behind it?). Two binary sets of polygons are taken from this, and subdivided again in relation to another polygon, until you are left with a **hierarchical polygon tree**. When navigated, this tree will draw in the correct order. The problem comes when one polygon straddles the plane of another: they need to be split, resulting in a **polygon count spike**. This slows things down. *Quake* is primarily a BSP engine using Z-buffering to sort between 3D objects and the world itself. It all comes together with **superpositioning** techniques, a set of protocols that combine the results of the dataset sorting with stand-alone models, an interface, and elements such as sky and horizon backgrounds.

"It all comes down to polygons," says Raven's Brian Raffles, head of the *Quake*-based *Hexen II*. "In a wilderness, you look out over vast areas, but the *Quake* engine isn't constructed for that kind of thing."

> **"THE TRICK IS DRAWING JUST THE RIGHT-SIZE TILES WITHIN THAT HIERARCHY AT THE RIGHT DISTANCE TO FOOL THE EYE INTO BELIEVING IT'S REAL."**
>
> **—JOE GILBY, TECH DIRECTOR OF LOOKING GLASS**

Looking Glass' *The Dark Project* and 3D Realms' *Prey* take a different path based on **portal cells**. In portal games, the world is made of connected convex polyhedrons with polygons allowing visibility between the polyhedron cells. "The idea is that these cells are stored in a graph structure such that, when traversed, they will sort correctly," explains Joe Gilby. "If you're in a room with an open door into another room, and a window into another room (all different portals), the far rooms are drawn first but just the pieces that are visible through the door and window are actually rendered. The cells subdivide the world into the pieces that quickly identify the areas that are of interest, and the objects which exist in those cells. Portal supports arbitrary sloping surfaces, and six-degrees-of-freedom viewing."

One advantage of this approach is the flexibility of defining the portal cells. Current BSP implementations require splitting polygons that straddle the extended plane of other polygons, so the more complicated the scene, the more polygons you have to deal with. Portals require splitting in order to maintain polyhedron convexity, but it's local to the immediate neighborhood and can be avoided by level designers, given a little training. This allows for more complicated settings. Also, the portal cell-based approach can avoid screwy effects such as characters and explosions piercing through walls, due to the portal cell drawing order. In a BSP renderer, the physics have to prevent objects in one leaf from penetrating into another or clipping, because the renderer will dutifully draw them in both.

"In portal, objects are confined to their containing cell, unless you explicitly say otherwise," says Gilby. "This makes the superpositioning come out right. We can also use the portal cells to define open spaces containing an atmospheric medium, such as flowing water, billowing smoke, and murky water."

PUNCH THE ACCELERATOR

Portals aren't the only new technique that modern game engines use. More and more game engines are demanding the advantages that 3D hardware acceleration affords.

Early work on the accelerated-only *Redline* (Beyond Games/Accolade) shows extraordinary frame rates and it's rendering far-off distances like never before, and that will be one of the new vistas opened by 3D boards. "While the hardware enables us to do what we're doing," says Clark Stacy of Beyond Games, "we still have to address the basic issues of how to do clipping, tune the player perspective, and get our fingers into the math of collision. Our approaches are new, but the problems we face with accelerators are as old as those we faced without them."

Another new technology is Intel's MMX instruction set. Through the use of **Single Instruction Multiple Data (SIMD)** techniques, MMX processes multiple data elements in parallel. The result is that a single instruction handles multiple chunks of data, allowing more simultaneous command processing and greater design flexibility. This also brings a general—and very noticeable—boost in overall performance. The *Unreal* team at Epic is staking a lot on MMX, which drives their new game technology. "The biggest thing we've been seeing with MMX is the ability to mix colored lights, and do a lot of mixing of things, something computers aren't usually too

GENTLEMEN... MEET YOUR ENGINES

The new crop of virtual worlds includes some hot new strides forward and some old warhorses that still have some kick left in them. Here's a rundown of the basics.

THE DARK PROJECT LOOKING GLASS

Looking Glass' new RPG/action game will live up to the standard set in *System Shock* and *Terra Nova* with a full "6D engine," ray-cast lighting, realistic physics modeling, motion-captured biped movement, photorealistic textures, portal-based levels, and a highly interactive environment.

JOE GILBY, director of technology, Looking Glass:
"More powerful hardware and higher polygon counts allow The Dark Project *to push not only the look of the visible architecture within the level, but also the game elements that take place within it. The most significant advance in current gaming technology for* The Dark Project *is in the gaming subsystems. Almost all objects will be live, and will be able to emit and receive actions. These actions can chain together into cause and effect, with planned and unplanned consequences."*

QUAKE ID

Quake's technology is well enough ahead of the curve to last through several games, including *Quake II* and *Hexen II*. It has a full six-degrees of freedom, ambient lighting, breakable objects, transparent glass, and fully rotational objects such as windmill blades. For *Hexen II*, Raven has added new lighting, breakable objects and entities, transparent polygons, dynamically changing light styles, and polygon scaling for growing creatures.

BRIAN RAFFLES, President, Raven Software:
"It all comes down to polygons: in the wilderness, you look out over vast areas, but the Quake engine just isn't constructed for that kind of thing. We're trying to cheat around it—the challenge of good design is trying to make the most of the technology you have—and it's just going to get better."

DEMON-1 INTERACTIVE MAGIC

Interactive Magic is developing their sims in-house by creating the DEMON-1 (Digital Elevation Model Optimization Number 1) engine for their *IF-22* flight sim. They're working toward photorealistic terrain based on satellite photos, a dynamic cockpit with on-screen switches, resolutions up to 1024x768, and full 3D acceleration.

DOUG KUBEL, vice president of technology, Interactive Magic:
"In addition to increasing the frame rate, the increased rendering performance will let us add more geometric detail to each 3D model. More raw polygon processing power also means we can add more objects, including true 3D clouds and improved smoke and flames. It also gives us back some of the CPU cycles, previously consumed by generating graphics, to do more things in the gamer's virtual world such as smarter, more lifelike AI, increased sophistication in the flight model, more accurate sensor and weapon modeling, and so on."

BUILD 3D REALMS

There's still kick left in the old mule after seven conversions. *Blood*, *Redneck Rampage*, *Shadow Warrior*, and *PowerSlave* are getting new results out of the engine, such as "room over room" sector-stacking situations (beams, ledges, etc.), fog effects, translucent water, and colored lighting. Not bad for the engine that originally propelled *Duke Nukem 3D* to the top more than a year ago.

GEORGE BROUSSARD, president, 3D Realms:
"Some of the things you can do in Shadow Warrior *will amaze you: driving forklifts and tanks, climbing ladders. The environment is the most interactive 3D game produced."*

PREY 3D REALMS

3D Realms' long-awaited follow-up to the BUILD engine will have shadow casting, colored dynamic lighting, a portal-based engine, and 16-bit art and color.

PAUL SCHUYTAMA, project leader, Prey*:*
"What our Portal Technology gives us is the ability to break free from static environment geometry—our environments can change geometry dynamically, during gameplay, in a far more interesting manner than simply opening doors and moving platforms that are found in most BSP-based engines. Also, our radiosity sytem lets us really take advantage of our engine's ability to display 16 textures."

REDLINE BEYOND GAMES/ACCOLADE

The engine called Daedalus, requires a 3D card to generate its excellent distance detail and adds scriptable effects for car physics to the behaviors of explosions, destructible geometry, and AI personality.

CLARK STACY, developer, Beyond Games:
"The engine is being designed with 3D acceleration as a system requirement to eliminate many of the compromises that other engines need to make. However, that means that even more is expected of the game in terms of detail and effects, and in order to deliver, we write as near to the hardware as possible. The core of sophisticated engine design is optimization strategies, novel and realistic collision detection, and—in the case of Daedalus—scriptable physics and effects."

UNREAL EPIC

Epic's MMX-drive gaming system features 24-bit color, high-resolution graphics at 8-bit frame rates, colored lighting, and continuous levels.

MARK REIN, president, Epic:
"In Quake, *you run around and kill everything. But in* Unreal, *because the visuals are so much clearer, you spend a little more time looking around and hunting for things, and being involved in the scenes rather than just running through them."*

VOXELSPACE II NOVALOGIC

Powering *Comanche 3* and *Armored Fist II*, this is the latest iteration of NovaLogic's terrain-imaging system. It allows for substantial increase in the quality of the texture-mapped polygons, plus translucent smoke, moving clouds, and real-time lighting effects.

DAVID SEEHOLZER, vice president of software technology, NovaLogic:
"For games such as F22, where you are generally higher off the ground, flying much faster, and covering truly huge areas the polygon engine is perfect. For situations such as those depicted in Comanche 3, *where you are generally very close to the ground, moving comparatively slowly and being very concerned with terrain masking, the VoxelSpace II engine really shines."*

good at," says Mark Rein, president of Epic. "With MMX we've upped the sound engine to 44kHz mixing. I'm not 100 percent sure what all the final benefits will be, but right now it enables us to do 24-bit color with colored lights at the same frame rates as we're getting in 8-bit color."

Technology such as this frees up processor power for other tasks. Environments can be more alive. *Unreal* offers a continuous world without the hard-level shifts we're used to in action games. The *Prey* world is completely destructible, so you can simply take out a wall instead of looking for a door. *The Dark Project* lets you tear apart the environment and is taking environmental interactions to extremes with its Act/React engine. This gives different properties to each object in the world. A table or set of drapes might have values for heat, pressure, impact, burn, melt, cut, damage, and so on, and these objects are scripted to interact with each other. An arrow can impact a rope, the rope will respond by severing, and the chandelier will come crashing down, explains Gilby. "The candles on the chandelier can scatter on impact, causing an oil slick to ignite. This feeds into the AI, because the chandelier impact will create a crash sound, which will alert the guards."

EYE IN THE SKY

Beyond simple graphics enhancements, Interactive Magic is putting the extra processor power to use in AI and flight modeling for their *iF-22* simulation, based on their new DEMON-I technology.

DEMON-I is made of two elements: the renderer and the data it uses, offering stiff competition to VoxelSpace II. Terrain textures are taken from satellite photos, touched up to eliminate clouds and other anomalies, assembled in a single composite, converted to 256 colors, and spatially reorganized (tiled) to make accessing them during gameplay more efficient. This terrain is then fitted to real-world elevation data taken from **digital elevation models (DEMs).**

DEMs are the future of modeling real-world locations, since they are accessible to everyone. Collected by various institutes and government agencies, the DEM provides elevation readings as numbers that can be plugged right into a program. Some DEMs can be downloaded off the Internet, and future games will allow you to plug them into your own custom worlds. Accolade used DEMs to make the course in *Jack Nicklaus 4*, and Mike Franco, producer of *JN4* is considering allowing users to input DEM data into the next versions of his course designer.

Interactive Magic's vice president of technology, Doug Kubel, promises 80,000 square miles of texture, sampled every 30 meters, for *iF-22*. This will result in a mammoth canvas for the flight sim. "The rendering system uses multiple levels of detail for the terrain and most of the 3D objects in the player's virtual world," Kubel says. "Using a lower polygon count and lower-res textures when objects are distant speeds rendering and also improves image quality by reducing aliasing. As you get closer to an object, the level of detail management uses the more detailed models and textures so you see lots of detail, but your frame rate doesn't suffer for it when you couldn't see it anyway."

DEMON-I is a sorted polygon engine (if it ain't seen, it ain't drawn), with 3D objects containing separating planes to speed sorting. For small primitive objects it uses 2-1/2D (2D objects with 3D positions in the world). All terrain, aircraft, ground vehicles, buildings, and air bases will be textured 3D objects, while explosions are a combination of 2D animated bitmaps for fire and smoke, 3D particles for small debris, and 3D models for large debris chunks. "There's also a sophisticated cloud-layer scheme," Kubel explains, "which provides for layers you can see the terrain through. You can even skim the cloud boundaries and go in and out of the haze as you fly through the bumps on the cloud."

Meanwhile, NovaLogic continues to use VoxelSpace II for *Comanche 3* and the forthcoming *Armored Fist II*. A "voxel" is what NovaLogic calls their technique of using volume pixels, rather than polygons, to create a world. Most pixels have x and y coordinates that place it on the screen, but a voxel has a third that determines its position in space.

Traditionally, an object is made of wireframes with textures layered on top like clothing. A voxel has its own color, depth, height, and width, so there are no flat surfaces. Everything is made of voxels rather than polygons. This makes terrain look sharp up close, but limits the amount of space you can map and can give the processor a serious hit. For this reason, NovaLogic used a new polygon engine for *F-22 Lightning II*, since the heights and large distances covered by a faster fighter jet make building a large enough voxel world impractical.

"The original VoxelSpace allowed us to have a terrain with a level of detail and variety which was unprecedented at that time," says David Seeholzer, vice president of Software Technology at NovaLogic. "VoxelSpace II takes that concept and expands upon it, providing a giant increase in the level of detail and the size of the world. The environments in *Comanche 3* are large, yet they retain realistic detail up close. It also seamlessly integrates high-resolution, highly articulated, texture-mapped polygon objects, giving us what we think is the best of both worlds for a helicopter simulation."

FASTEN YOUR SEAT BELTS

At the end of the day, we're talking about more realistic virtual worlds. The result will be graphical environments in which a hiccup in frame rate or a badly clipped polygon won't shock you out of the experience of the game.

Programmers are taking on no small task: trying to approximate reality. In a few short years we've come so far that one can't even imagine the next strides the technology will take. Hardware makes a leap, and software follows. Software ambition surges and hardware scrambles to accommodate it.

What we want to do with software and we know what we are able to do with hardware don't always meet, but when the right engine's fed the right fuel, you have a wild ride on your hands.

Additional reporting by Colin Williamson

OPENGL VS. DIRECT 3D

Quietly raging behind the scenes of the gaming industry is an extremely heated developers' war over 3D libraries. Aside from using proprietary drivers for each hardware board, there are essentially two choices when coding a Windows-based 3D game: Microsoft's Direct3D or Silicon Graphics' OpenGL. Both systems support the new breed of 3D boards, including the 3Dfx Voodoo, the Rendition Vérité, and the Matrox Mystique. Many believe that when it comes to speed and performance, OpenGL is the winner—but because of Microsoft's muscle, odds-makers think that Direct3D will win the day.

So how do the two compare? One of Direct3D's limitations is that it consists of two "layers" from the actual program to the video hardware. The Direct3D program communicates with two lower-level systems called HAL (Hardware Abstraction Layer) and HEL (Hardware Emulation Layer) that interface with the actual 3D hardware. This results in a good deal of slowdown, unlike OpenGL's "lowest level" interface, which talks directly to the 3D board with no layers in between. With smoother pipelining and support for more graphical effects, OpenGL *should* be the clear-cut winner—but this may not turn out to be the case, due to a surprising surge of Direct3D development and a lack of OpenGL releases.

Kicking off this clash of the titans was id Software's John Carmack, who managed to annoy Microsoft higher-ups by using OpenGL instead of Direct3D in the hardware-accelerated version of *Quake*.

The upcoming release of DirectX 5.0 will supposedly include optimizations to Direct3D and several new rendering features, though it's uncertain if the extra layer of software will be eliminated. One thing's for sure: Direct3D is here to stay, so OpenGL has a fight on its hands if the API is to survive.

— Colin Williamson

boot 12-step program

DEALING WITH YOUR PC **OBSESSION** DAY TO DAY BY BREAKING IT DOWN INTO 12 **EASY** STEPS

This month

bootMarking your PC

boot *scoured the known universe in search of benchmarks that would rock your motherboard, flex your MMX, and pump those polygons.*

And we found them.

Now you can give your system a taste of what it's like to be sent to the bootLab for evaluation.

The boot-o-meter is out and the bootMarks *are in. Now, with precise benchmark scores and frame-rate results, you'll get the 411 you need. This collection of abstract and real-world torture tests will make your computer sweat, and will separate the contenders from the pretenders.*

When you see the results on the pages of boot *you can either go for the hardcore numbers, or use the chart to gauge how a particular system did at a glance. The complete suite of* bootMarks *usually takes about eight hours to complete. The tests provided on the* bootDisc *should take no more than an hour to run on your machine.*

Six of the 10 bootMarks *can be found in the Feature section on this month's* bootDisc. *Each is displayed as a button which launches a dialog box with buttons pointing to the web pages explaining that particular* boot-Mark *in detail, and another that installs it.*

The bootMarks *can play a role in your decision-making when buying a new sytem, but shouldn't be the deciding factor. No test is 100-percent foolproof, and the art of reviewing a system goes beyond benchmarking—it's looking at how a system is put together, the choice of components, the "out-of-box" experience, and much, much more.*

Step into the shoes of the bootEditors for a day, and see how your system handles the bootMarks.

— Andrew Sanchez

THE REAL-WORLD BENCHMARKING
The new meter has the precise scores for each category benchmarked. Plus, the color bars to the right give you a quick idea of how well the system performed in that category.

It's simple: The farther right the bar reachs, the better the system scored. Green means the system performed on par or beyond what we expect of a current system. If you see nothing but red, the system performed below expectations.

THE PLUSES AND MINUSES
Here's where we list the best and worst a system has to offer.

THE CONTACTS
Pricing, phone numbers, and URLs are located here if you want more information from the company.

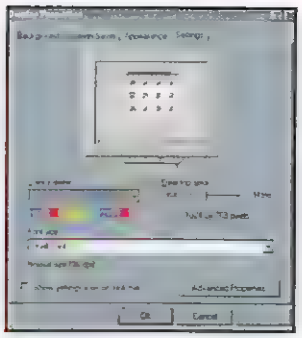
THE BOOT VERDICT
The one that really matters. This score reflects how we felt overall about a sytem, taking into account the benchmark results, quality of parts, usability, overall performance, and our intense, under-the-hood scrutiny.

1

TOOLS OF THE TRADE

The only other tool you'll need besides the *bootDisc* is a stopwatch. Try to get a digital one, but don't go overboard.

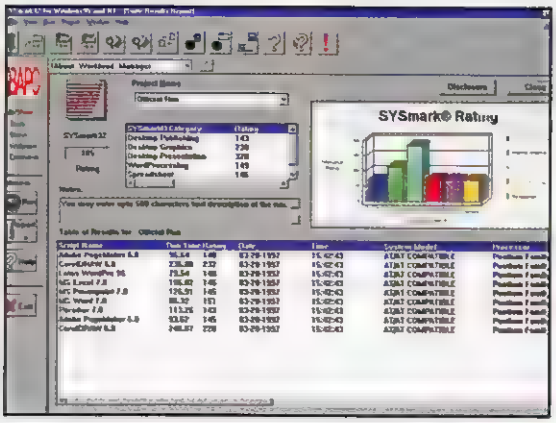
First, time how long it takes to boot up. From the moment you flip your power switch, your system's under the clock until there's no hourglass mocking you. Record that time. Now, shut down your computer via the Start menu. Begin timing when you click on the OK button, then stop when you see "It's now safe to shut down your computer" or your monitor shuts off.



2

PREPARE FOR BATTLE

Set your desktop to 1024x768, 16-bit color depth, and set your monitor refresh to 75Hz. Take a deep breath, and prepare to enter the *bootMarks*.



CPU/MOTHERBOARD

The main *bootMark* test, created by Symantec, evaluates subsystem performance—in particular, the ability of your CPU, memory, PCIset, and motherboard to work as a finely tuned number-crunching beast. If you plan to indulge in some overclocking, the *bootMark* is a great way to see how much extra speed you've squeezed out of your system.

INSTALLATION: Installation is straightforward, except it doesn't create a Programs group so it'll need to be launched from the Start Menu under Norton System Information.

NOTE: If you already have *Norton System Doctor* installed, you already have System Information and don't need to install the *bootMark* software.

3

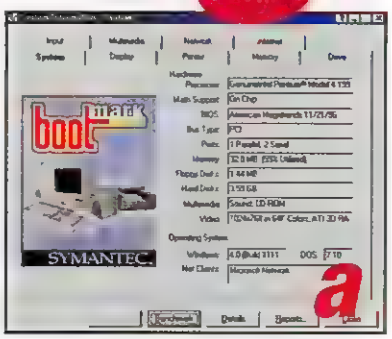
Fire up the program by starting the *System Information* program found inside the Norton System Information folder. Once the splash screen disappears you'll see screen a.

Click on the Benchmark button at the bottom and step back for a second or two. When it's finished, you'll see screen b.

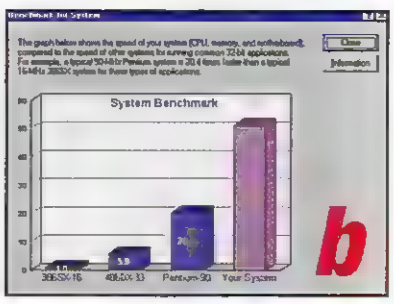
Record "Your System" number on the right-hand side

The higher the number, the better.

THE RANGE: Scores start at zero, with 75 being the average you should expect. Only the most battle-hearty systems will ever surpass 150.



a



b

WIN95 APPS

4

BAPCo's *SYSmark32 for Windows 95* is a comprehensive suite of script-based real-world application tests which guage your system's ability to handle the everyday rigors of word processing, spreadsheets, and more. Hey, everyday can't be fragday.

Once the benchmarks are complete, *SYSmark32* computes an Official Score, which is based on the six individual scripted tests.

The higher your Official Score, the better.

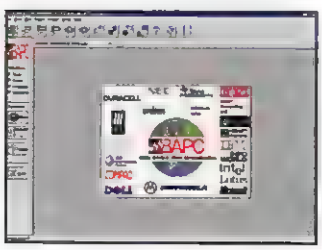
This benchmark is the longest one we run, taking anywhere from two hours for a good system, to five hours for "not-so-good" systems. It's long, but it's automated, comprehensive, and it utilizes six real-world applications.

The six categories tested and programs used are:

WORD PROCESSING *Microsoft Word 7.0, Lotus WordPro 96*
SPREADSHEET *Microsoft Excel 7.0*
DATABASE *Borland Paradox 7.0*
DESKTOP GRAPHICS *CorelDraw 6.0*
DESKTOP PRESENTATION *Lotus Freelance Graphics 96, Microsoft PowerPoint 7.0*
DESKTOP PUBLISHING *Adobe Pagemaker 6.0*

We'll print the composite Official Score, but you can get the entire *SYSmark32* results for systems we review on the *bootNet*.

THE RANGE: Consider a result of 100 as minimal system scoring, with 200 being the average *boot* system. If you blast past 300, you're on fire!



DIRECT 3D

5

Microsoft's much-maligned 3D API is the force behind the PC's explosive growth in texture-mapped polygon presentations. Direct3D benchmarking is the subject of heated controversy, but we've decided on the *Terramark v1.0* benchmark—a byproduct of Eidos' soon-to-be-released *Descent* killer, *Terracide*. Why?

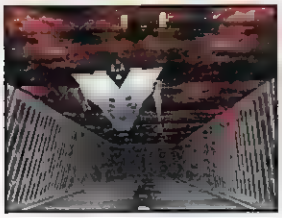
Because, this benchmark is the lesser of all evils.

Microsoft's own suite of DirectX benchmarks, based on abstract texture-mapped tunnels and cubes, reports less-than-accurate results.

Hellbender and *Monster Truck Madness* have no way of running a scripted benchmark to provide exacting results each and every time.

WizMark 2.0? We use it to test Direct3D functionality, but because the benchmark is made by 3Dfx (and is biased toward the Voodoo chipset), it's hard to stand behind it.

Not only do most chip developers dig the Terramark, it's the only Direct3D benchmark that uses an actual gaming engine to derive its score. As each subsequent scripted test runs, Terramark enables more 3D acceleration features, such as bilinear filtering, alpha blending, fogging, MIP mapping, and more. If a card fails a particular test, it's noted in the final result. There are three levels of Direct3D card functionality, with each completed level of suites producing a numerical score.



The higher the score, the better.

We take all three scores and add them up. For example, a 3Dfx-laden system may produce a Level 1 score of 267, Level 2 score of 270, and Level 3 score of 269. Add all these up and you get a Total Terramark score of 806. This is the score we present. If a level fails, we add the remaining scores. Some cards, such as Matrox's Mystique, fail the Level 3 suite, so the Total Terramark score represents the sum of the Level 1 and Level 2 scores. Others, such as the S3 ViRGE, refuse to run the benchmark at all. This doesn't mean that the ViRGE can't run Direct3D apps, it's simply a case of the ViRGE and Terramark not seeing eye-to-eye.

As Direct3D drivers mature and *Terramark* becomes more robust, we'll utilize new revisions and keep you up to date.

THE RANGE: If all the tests fail, you'll come up with a big goose egg—500 would be the median score. Score more than 1000, and we'll be asking you where you got that prototype AGP card.

HARD DRIVE

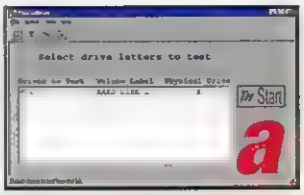
6

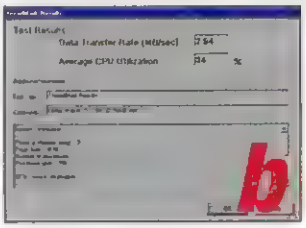
Adaptec's *ThreadMark v1.0* tortures your hard drive subsystem, recreating intense I/O activity under Win95 and NT with a mixture of single and multithreaded read and write requests across a range of requested block sizes. Once the benchmark is complete, it will indicate your hard drive subsystem's data transfer rate (in MB/sec) and CPU utilization (as a percentage).

INSTALLATION: Install the *ThreadMark* application via the *bootDisc* interface and launch it through the Start Menu. (It can be found under ThreadMark in the Programs group.)

NOTE: You'll need 126MB free on the drive you want to benchmark.

Once you launch the benchmark, simply press the ThreadMark Start button on the right-hand side of screen a and sit back.





This test will take about 30 to 45 minutes. Upon completion, you'll get a detailed report of your hard drive subsystem (see screen b).

THE RANGE: A 1MB/sec result is considered bare-bones minimum scoring, with average EIDE systems scoring about 2.5MB/sec. Score anything past 5MB/sec and you're ablaze.

DOS GAMING

9

For DOS performance, we use id software's *Quake*—everyone's favorite CPU pusher and VESA 2.0 inspector.

INSTALLATION: You'll need to have either the full or shareware version of *Quake* installed. The shareware version can be found on *bootDiscs* 02 and 04 as well as at id's web site (**www.idsoftware.com**). The *Quake* button in the *bootDisc* interface launches a setup application that will copy over the bootMark.dem file to the directory you specify.

NOTE: Make sure you choose your Quake\id1 subdirectory as the target for this file.

Now, drop to DOS and fire up *Quake*. Make sure you have version 1.06 or greater. If your version is not up to snuff, we've included the v1.01-to-v1.06 patch, as well as the latest Vérité and *GLQuake* patches in the Patches folder on this month's *bootDisc*.

Now set your video resolution to 640x480.

What? You don't see that resolution as an option? Congratulations! Your video card is not VESA 2.0 compliant! Run out and download the latest version of SciTech's *Display Doctor*, or check your video card manufacturer's web site for VESA drivers. Once you've set your resolution, ensure that *Quake* is set to full screen—no status bars on the bottom.

Start a new game. Pull the console down by pressing the tilde key (~). Type in `timedemo bootmark` and hit Enter. Press the tilde key once and relax. *Quake* will run through our demo and afterwards will spew an average frame-per-second count.

Higher frame rates are always better.

If you own an accelerated version, run the bootmark.dem with that and observe your frame rates. You should be getting at least twice the rate of unaccelerated *Quake*.

THE RANGE: 10fps is the minimum a DOS-based video card should do in 640x480 *Quake*, with 15fps being the average score. Hit 20fps unaccelerated, and you may not need Voodoo to see magical results.

DIRECTX GAMING

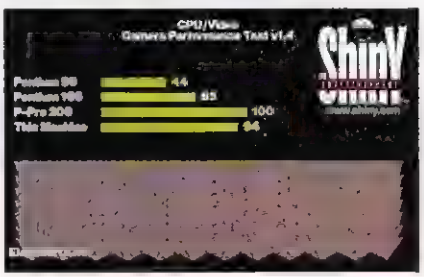
10

Shiny's *MDK Performance Test v1.4* prods your floating-point processing power and your video card's DirectX compliance and DirectDraw performance.

A higher score is better.

INSTALLATION: The installation will create several icons on your desktop. You'll need DirectX drivers. The 3.a drivers can be found in the *bootDisc* Feature interface. You'll need to restart your computer after installing DirectX. The desktop icon that launches the *bootMark* is the *MDK Performance Test for Win95*. Launch it. After five seconds, the bottom status bar and number labeled This Machine will be your DirectX score.

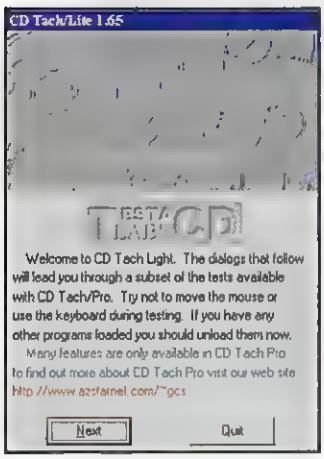
THE RANGE: Burn 60 in your brain. This is the bare minimum a system should perform, with 90 being the optimal score. Cruise by a score of 120 and your system is the DirectX bomb!



7 CD-ROM

CD Tach/Pro v1.65 is the Win95-native benchmark from TestaCD Labs. Previously responsible for the equally exhaustive DOS-based *CD Stone*, this benchmark pokes at your CD-ROM drive and reports transfer rates at different points on the disc (to illustrate the difference between CLV and CAV drives), CPU utilization at maximum obtainable speed, full-stroke and random access times, and burst tests.

On the *bootDisc* is a lighter version of the test we use for benchmarking, but it'll give you an idea of how your system's CD-ROM drive stacks up against the suggested specs.


CD Tach/Lite 1.65
Welcome to CD Tach Light. The dialogs that follow will lead you through a subset of the tests available with CD Tach/Pro. Try not to move the mouse or use the keyboard during testing. If you have any other programs loaded you should unload them now.
Many features are only available in CD Tach Pro
To find out more about CD Tach Pro visit our web site
http://www.azstarnet.com/~gcs
Next
Quit

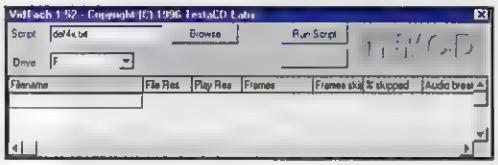
INSTALLATION: Launch *CD Tach*'s setup program via the *bootDisc* interface. Once the icons are created, launch the program. When prompted, click on the Next button to proceed. It will give the throughput of your CD-ROM drive, the CPU utilization up through 6x, and a taste of the video test we run in-house (*VidTach*). The video included on the disc is different from the one tested and is strictly for illustrative purposes. If you're interested in getting the full suite of tests, check out **www.azstarnet.com/~gcs/**.

As you go through each step, record your score. When you've finished, you'll have the stats you need.

THE RANGE: 1500K/sec is *boot*'s minimum acceptable CD-ROM score, with 1800K/sec being the average. Flying past 2100K/sec ensures your CD-ROM subsystem of Kick-Ass status.

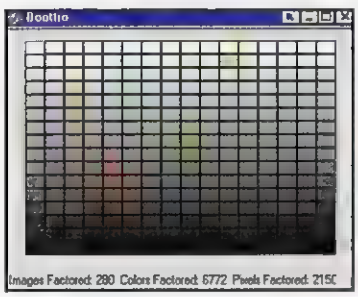
8 WIN95 FMV

TestaCD Labs' *VidTach v1.52* streams a 640x480 video off the CD-ROM and plays it scaled full-screen at 30fps onto a 1024x768 screen. This tests your CD-ROM's sustained throughput, your CPU's raw horsepower to calculate the resized image, and your graphics card's ability to display it all.



Or maybe none of that. Most modern graphics chips have a hardware video scaler that can do all this work without any load on your CPU and without dropping a frame, but surprisingly, few graphics drivers accelerate Video for Windows, which *VidTach* uses.

THE RANGE: Scores on *VidTach* range from 0 to 100 percent frames played.



11 MMX PERFORMANCE

Armed with the latest v4.0.0.109 patch, Equilibrium's palette-processing powerhouse *DeBabelizer Pro* turns into a mighty MMX-armed application, capable of drastically increasing your system's processing performance… provided you have those 57 new instructions. This one requires your stopwatch.

INSTALLATION: Setup will direct you to install the bootMark.avi movie as well as the super palette used into a bootmark\debab directory on your hard drive. Install these anywhere you want, you'll need to open them through *DeBabelizer Pro*. Next, Setup will install the *DeBabelizer Pro* demo.

NOTE: This demo version of *DeBabelizer Pro* is not MMX-enabled. It's only on the *bootDisc* to illustrate the test, although it can be upgraded to the full version. If you already own a full copy, make sure you're running the newest version. The patch files to bring it to date can be found in the \patches\debab directory of the *bootDisc*.

Launch the program. Maximize your window, go to the File menu and Open the boottro.avi file. A window containing the movie will appear. Go to File and select Open Super Palette. Find the boottro.dbp file and open it.

Look at the Super Palette window on the right and the little Action Arrow in the upper right-hand corner.

Move your cursor over to the Super Palette's window. Click and drag that Action Arrow from the boottro.dbp window into the center of the boottro.avi window. When prompted at the Apply Movie Operation, choose Entire Movie, get your stopwatch ready, and start timing the second you hit that OK button.

When the operation's complete, stop the clock and record your time.

THE RANGE: 410secs is the bottom end of the scale, with 370secs being the comfort zone. If your system can blast past 330secs, it rocks.

12 CPU/DISK

Microsoft's *Visual C++ v4.1* delivers a swift kick to your CPU, memory, and hard drive subsystem by timing how long it takes to recompile the Microsoft Foundation Classes.

This one also needs your stopwatch.

If you own *Visual C++*, fire it up, go to the File menu and choose Open Workshop. Find the mfcdll.mak file that comes with *Visual C++*, and open it. Accept all the default values. Now, add the "libname=mfc40" command by going to the Build menu, choosing Settings and manually edit the command line.

Once you've done that, choose the Rebuild All from the Build menu, start your timer, and watch the fur fly.

When the build is complete, stop timing and record your results.

As usual, the lower the time, the better.

THE RANGE: Accept 250secs as your bottom of the barrel, with 175secs being the average time. Compile below 100secs and you'll be creating your own apps in no time.

boot white paper

YOUR PERSONAL TECH **BRIEFING** ON THE **CONCEPTS** AND **COMPONENTS** THAT MAKE UP THE **PC** EXPERIENCE

this month:

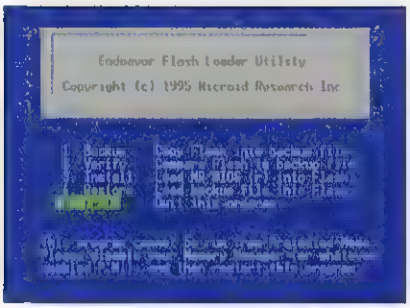
Knowing Your BIOS

Just because it works doesn't mean your system is being all that it can be. Your computer may recognize a new hard drive with no effort on your part; but to max out access rate and throughput, you have to take matters into your own hands. That means mucking with the BIOS. The BIOS (Basic Input/Output System) is the lowest level of a computer, defining routines that control the transfer of information between the operating system and the hardware. It controls the machine. At startup, it runs self-tests, sets up basic options, configures add-on hardware, and then boots the OS. Yet, despite its huge impact on the system's overall performance and stability, few people know the BIOS is even there. Because incorrect BIOS settings can leave a machine deader than a doornail, system manufacturers have been removing options, opting for hard-coded settings that "always work," even at the cost of performance. But if you're a hardcore tweaker, you need to know how to tune your machine. This month's White Paper shows you how to optimize your BIOS for maximum performance.

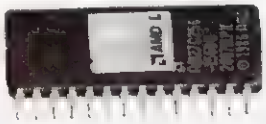
— Sean Cleveland

MEET YOUR MOTHERBOARD MANUFACTURER

Even if you don't want to tweak, it's still a good idea to be current with the newest BIOS revision. Most modern motherboards' flash-ROM-upgradable BIOS allow you to install the latest version with a utility distributed by the manufacturer. You can usually download them freely from the Internet.



Most Flash Loaders are pretty straightforward, such as this one. But this shouldn't deter you from reading the instructions.



A ROM BIOS chip. Only older motherboards continue to use these types of chips. Remove the chip with a chip puller, not a screwdriver, because one slip could ruin your motherboard.

Some BIOS are contained in a ROM chip that can't be reprogrammed. The only way to upgrade them is to order a new chip with the updated version, which can be expensive ($50 to $90) and requires that you replace the chip.

GETTING IN

First, get into your BIOS configuration screens. Look for a message on the screen right after power-on, saying something along the lines of "Press F1 to enter setup," and act accordingly. Most systems only pause for an instant, so if you miss your chance reboot and try again. Once you're in, feel free to look around, but be careful not to "Quit and save changes" unless you're sure of what you've changed. BIOS settings are stored into nonvolatile CMOS memory, and if you store bad settings that prevent you from booting up, you'll need to clear your CMOS to restore the factory defaults—a tedious procedure that usually involves fiddling with motherboard jumpers.

MEMORY AND WAIT STATES

DRAM is rated to run at a specific access speed—typically 60ns to 70ns, but it can be as high as 100ns or as low as 50ns. Since the CPU is usually faster than the main memory, wait states are necessary to slow the flow of information. The wait state number determines how many ticks of the system clock the CPU has to sit idle waiting for the memory to catch up. The optimal setting would be 0, meaning that the CPU never has to wait, but wait states can be set as high as 3 on systems with slow memory chips. Most modern machines have wait states set to 1 by default, and each wait state adds approximately 30ns of RAM access speed.

If your system is set to access RAM too fast, data can corrupt and parity errors will lock up the machine. But with too many wait states you're running in slow motion. The goal is to set the speed at the most aggressive setting that doesn't result in a failure. It's important not to mix different speed memories because RAM only runs as fast as the slowest part.

DOWNLOAD AN UPGRADE

Listed below are some common motherboard manufacturers and their URLs. If you don't know who made the motherboard, don't panic. Just pop the case and look inside. The name and model is usually printed on the board.

Motherboard manufacturers usually display their company name on the board. Unfortunately, there are no standards set for this, so sometimes the information isn't there at all.

Air	www.airwebs.com/download.html
Asus	www.asus.com/downloads/bios-dl.stm
Intel	www.developer.intel.com/design/motherbd/index.htm
Ocean	www.ocean-usa.com/ocean/c_bios.htm
Micronics	www.micronics.com
Tyan	www.tyan.com/html/drivers.html

GETTING THE FULL STORY

Tweaking your BIOS will teach you a lot about your machine and may even provide a sizable performance boost. But beware, you're messing with the raw internals of your system, and one false move can scramble your hard drive or render your system unbootable. Don't be afraid to experiment, just be careful. If you have any questions concerning specific settings, visit your BIOS maker's web site for a more in-depth explanation than the usually skimpy built-in help provides.

AMI (American Megatrends Inc.) www.megatrends.com
Award (Award Software International Inc.) www.award.com
IBM SurePath www.surepath.ibm.com
MrBios (Microid Research) www.mrbios.com
Phoenix (Phoenix Technologies Ltd.) www.ptltd.com/nhome.html
Tti Technologies (AMI and MrBios upgrades) www.ttitech.com

Another storehouse of information is the BIOS Survival Guide at www.lemig.umontreal.ca/bios/bios_sg.htm. *This online manual by Jean-Paul Rodrigue and Phil Croucher explains each portion of a typical BIOS in microscopic detail.*

This is a good example of how some BIOS manufacturers give you complete control of the settings. It's a boon if you know what you're doing.

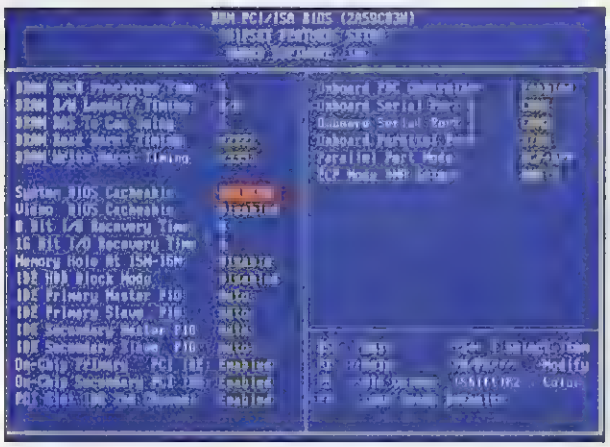
CACHE CONFIGURATION

To compensate for slower main memory, systems generally have up to 512K of fast SRAM installed as a CPU cache. The cache stores the most recently accessed data and program code, allowing the CPU quick access without hitting main memory. The CPU's small internal cache is even faster than the external cache. It's sort of a cache for the cache.

Make sure the Internal and External Cache Memory are enabled. This really affects the performance of your PC. These settings are frequently overlooked by manufacturers and could cost you performance and, ultimately, wasted money in unused hardware. Two types of cache RAM are available: Pipeline and Sync-Burst. Pipeline uses more clock cycles on its first request, whereas Burst doesn't and delivers more speed. Enable them if you have them, as they greatly enhance overall system performance. Be careful, though, enabling either of them when they're not present can freeze the system.

SHADOW-RAM SETTINGS

ROM chips are slow compared to RAM. A technique called "shadow RAM" can be used to copy the system BIOS and VGA code—typically stored on slow ROM chips—into RAM. Some BIOS versions can Write-Protect regions of shadow-RAM to prevent errant code from corrupting the BIOS and crashing your system. If your BIOS offers these features, make sure they're turned on.



Award BIOS gives you the ability to shadow and cache the system BIOS and the video BIOS.

HARD-DISK SETTINGS

SCSI cards often provide a secondary BIOS to control your SCSI settings, since most mainstream PC BIOS don't speak SCSI. If you're not blessed with a SCSI, it's wise to make sure your hard drive conforms to the ATA (IDE) standard of at least a PIO (Programmed Input/Output) Mode 3. The ATA standard defines four PIO modes that affect data transfer rates. PIO Mode 0 is compatible with all fixed hard drives and conforms to the original PC standards. It uses an interrupt to transfer a single sector at a time. PIO Mode 1 polls for readiness to transfer each sector and doesn't wait for an interrupt. PIO Mode 2 is a block-transfer mode that makes use of IDE drive capabilities to transfer a group of sectors in a single burst. PIO Mode 3 is a 32-bit block-transfer mode (the others being 16-bit) that uses the motherboard's 32-bit bus to achieve the highest transfer rate possible. PIO Mode 4 is the same as Mode 3 with an even higher throughput, while PIO Mode 5 was never incorporated into the standards. Setting PIO beyond the specified mode setting of your hard drive can lock it up or corrupt data.

PIO Mode Transfer Rates

PIO Mode	Cycle Time	Transfer Rate
0	600 (ns)	3.3 (MB/sec)
1	383 (ns)	5.2 (MB/sec)
2	240 (ns)	8.3 (MB/sec)
3	180 (ns)	11.1 (MB/sec)
4	120 (ns)	6.6 (MB/sec)
5	90 (ns)	22.2 (MB/sec)

PLUG AND PLAY/PCI POKING

For some, the words "plug and play" conjure notions of hardware bliss. For others, they are the harbinger of hell. The BIOS should check for PnP cards and then check them against the requirements of other installed components. It then feeds this information into the operating system, typically Win95, which in turn assigns IRQs (interrupt request settings), DMA (direct memory access) settings, and PORT settings. The problem is that the BIOS often struggles when assigning settings to devices on the ISA bus. This is compounded by the fact that most PCI cards have a limited number of IRQ settings that they will work with, and sometimes all the free IRQs are gobbled up by the ISA cards, which must then be changed manually.

The POST is Toast

Nothing's worse than firing up your computer and waiting... and waiting. Skipping the Power-On Memory Test will shorten boot time, as wil. disabling the Floppy Seek and the System Warmup Delay, (the latter gives the BIOS more time to recognize IDE hard drives). Newer drives don't require this.

Unless you suspect a problem, all POST tests are a waste of time.

boot worthy

EACH MONTH, **BOOT** EDITORS GATHER THE BEST **PRODUCTS** IN A SPECIFIC CATEGORY AND DEEM THEM: BOOT**WORTHY**

this month:

Pure Printer Power

Face facts. The paperless office has not arrived. We're still cranking out as many hard copies as we were before; only now we throw old printouts into recycling bins. We exchange e-mail and download images just to print them. We're still not completely paper-free, but we have achieved closer screen-image-to-printout consistency. Think back to the days of printer yore, when dot matrix printers spewed odd characters onto paper, calling them letters, and daisy wheels hammered out a page every 10 minutes. Think back, and thank the printer gods for inkjet and laser printers. Today, practically anything your video card can push onto your screen can be slapped onto paper by these babies.

Hewlett-Packard OfficeJet Pro 1150C

Everything you need to set up an office is packed into the OfficeJet 1150C's 10.5x15-inch footprint. As a stand-alone unit, it operates as a color or black-and-white copier, with controls to adjust the brightness, magnification, and paper type. Particularly cool is the Auto Enlarge feature, which resizes an image to fill the page, yet maintains length-to-width ratio. HP's CopySmart technology isolates areas of text for special treatment allowing you to fine tune text enhancements and graphics elements separately. A dedicated processor enhances image quality through noise and pattern reduction, color balancing, and contrast adjustment.

The 1150C scans 300x300dpi at 256 colors, and when more depth's required, it musters 24-bit color by dropping the dpi to 100x100. The scanning software features a simple interface with easy pre-set configurations for text OCR and high-detail pictures. Like every good scanner, it imports into any TWAIN-compliant software (such as *Photoshop*) with little fuss, but more amazingly, the OfficeJet's *PictureLink* software adds two new menu items to several 32-bit-compliant applications for acquiring OCR text or importing graphics. With a simple menu command you can plop a scan into anything from a letter to your grandma to a business expense report.

The 1150C works through a standard bi-directional parallel port, but performs the best through an enhanced capabilities parallel port (ECP). Printouts range from a max monochrome res of 600x600dpi, dropping to 600x300dpi for color. HP's ColorSmart technology (the printer version of CopySmart) identifies and performs separate adjustments to the print methods for text and graphics. The printer cranks out monochrome text at 7ppm, but takes a ponderous 4 minutes to print a full-page color image at the best print quality. Graphic printouts look sharp with good color saturation and only slight banding.

The included bundle features Adobe *PhotoDeluxe LE* and Caere's *OmniPage LE* OCR in addition to document management software, a handy font manager, and several free fonts.

Multifunction printers are the way to go. Just ask anyone who's ever installed both a flatbed scanner and a printer on the same system. Along with the hypertension from setting up a finicky SCSI adapter for the scanner and tweaking your parallel port for the printer, comes the realization that your desk is now taken over by both devices. The OfficeJet 1150C integrates it all into one tidy little bundle.

The OfficeJet 1150C points the way for the evolution of desktop printers: from output-only devices to complete desktop imaging centers.

Inkjet
600x600 monochrome; 600x300 color

PRICE: $1,000
COMPANY: Hewlett-Packard
PHONE: 800.333.1917
URL: www.hp.com

Alps Masterpiece MD-2300

PRICE: $750
COMPANY: Alps Electronics
PHONE: 800.825.2577
URL: www.alpsusa.com

Designed to compete with high-quality, color laser printers, the new Alps Masterpiece prints impeccable near-photographic quality images that resist moisture and smearing. Unlike standard inkjets, the MD-2300 prints by heating up the print head instead of the ink. The dye-sublimation printhead turns the dye-based inks in the printer's ink cartridges into vapor, sublimating them into the paper. The result is a no fuss, no muss printing method that goes on dry and stays dry. It's the anti-perspirant of inkjet printers.

But it's slow. Printing color graphics requires four passes across the print head—one for each primary color. Expect less than 1ppm with standard monochrome print jobs, and for a 600x600dpi photographic-quality printout you might as well break out a deck of cards, because it could take more than 15 minutes to finish the job.

Solid colors are handled brilliantly by the MD-2300, resulting in fully saturated and vibrant images without banding. The colors don't fade in direct light and the image doesn't smudge—even when immediately removed from the printer. Snazzy metallic inks, such as gold and silver, are also available.

Where the Alps MD-2300 really shines is with continuous tone 24-bit images, producing more realistic printouts than those from many laser printers. The printer outputs on plain paper and transparencies, and takes iron-on transfers, greeting-card stock, or anything else you feel like stuffing in its 100-sheet autofeeder.

Color-matching options let you manually adjust the printer's color balance, or pick from presets for business graphics, photographs, and graphic art. The MD-2300 comes with Adobe's *PhotoDeluxe* software and the Alps *Image Library CD* photographic-quality clip art for your printer.

If you want high-quality printing and you're not ready for the commitment that goes into a color laser printer, the Alps Masterpiece MD-2300 is for you.

Inkjet/Dye sub
1200x600 monochrome;
600x600 color

Epson Stylus Color 800

PRICE: $349
COMPANY: Epson
PHONE: 800.463.7766
URL: www.epson.com

The Stylus Color 800 is the dribble-proof high-res inkjet alternative. It spits out both color and monochrome documents at 720x720dpi (1440x720 on coated paper), and it does it fast. We're talking 6ppm for monochrome and 5ppm for color (the printer maxes out at 8ppm in low res). With options for an Ethernet connection and upgrades to PostScript Level 2, this is a printer your entire workgroup can drool over.

Like the Alps Masterpiece, the Stylus improves on current inkjet technologies. Its patented Micro Piezo, piezoelectric print technology, creates less heat buildup and offers finer dot control than standard thermal inkjet technology by forcing ink onto the page through electromechanical pressure, not by the run-of-the-mill boiling process used by most other inkjets. This results in precise placement of dots with no excess splatter hitting the page.

The Stylus also uses new dye-based inks rather than pigment-based colors. The Quick-Dry ink sinks deeper into the paper, looks richer, and dries faster. The results of this approach are apparent in the prints. Monochrome text looks near-laser quality and color images are extremely clear and fine. With continuous tone images, dots are visible in the background, but foreground images print smoothly with solid, consistent colors.

Along with excellent printer configuration and monitor software, the Stylus ships with Epson's Color Pak. This includes Sierra On-Line's *Print Artist* for designing signs, banners, and calendars; and, of course, Adobe *PhotoDeluxe*.

Inkjet
1440x720

Tektronix Phaser 550

OK, so maybe this is more than you're willing to pay for the perfect printing machine, but at least you know at what price perfection can be had. You can always skip that new car. Hell, strap some wheels on this monster and you can ride the 117-pound beast.

Just think about it. If you started up a digital-photo printing service you could make your money back, and you'd still have this behemoth printer. If things get rough, you can always pull out the imaging unit, the fuser, and the four toner cartridges and have enough room to live inside it.

Beyond the fact that it seats four, what really sets the Phaser 550 apart from the other printers featured here is that it's not a bilevel printer, which means that its colors (cyan, magenta, yellow, and black) are not limited to fully-on or fully-off. Because of this limitation, bilevel printers are limited to combinations of the basic CMYK values (eight colors total)—everything else is dithered. But, considering how small the dots are on the new inkjet printers, this is rapidly ceasing to matter for all but the most high-quality images. In this gathering, however, there is a distinct difference between the Phaser and the rest.

This is a business printer and there's no getting around it. The included *PhaserLink* software allows you to assign your printer a URL so you can check printer status through your browser. Built-in TekColor Dynamic Correction provides advanced color settings for bright presentation colors, display matching, and several printing press output specs.

Output quality is incredible. Images print on the near side of photographic quality. Graphics offer sharp edges, smooth gradients, and solid, thin lines. More importantly, you won't see the thin light or dark bands along the edges of solid areas, which mar the output from most color laser printers. Text quality is as crisp and clean as what you'd expect from a 1200dpi monochrome laser printer, and images fully rock.

Laser
1200x1200

Hewlett-Packard LaserJet 5L Xtra

The easy-to-use LaserJet 5L Xtra is the Kellogg's Corn Flakes of printers. Not only is it fortified with nine essential vitamins and minerals, it's cheap and it's fast. That's what puts the 5L Xtra at the top of the laser printer heap. With a street price of $500, anyone can have the power of laser-quality printing on their desktop.

HP's resolution enhancement technology goes a long way to refining text quality and image clarity. Graphics are enhanced by the 5L's microfine toner, and text output is sharp without noticeable fuzziness. All this produces crisp output that's fully saturated without any discernible loss of detail. Printouts from the 5L hit the page dry and stay that way. They don't fade or smear.

In one of the more interesting bundling deals, the 5L Xtra comes with Netscape *Navigator Personal Edition 2.0*, with custom bookmarks allowing 5L owners easy driver updates. Also included are eight other tchochke programs and 70 TrueType fonts. Surprisingly, this printer doesn't include Adobe's *PhotoDeluxe* software.

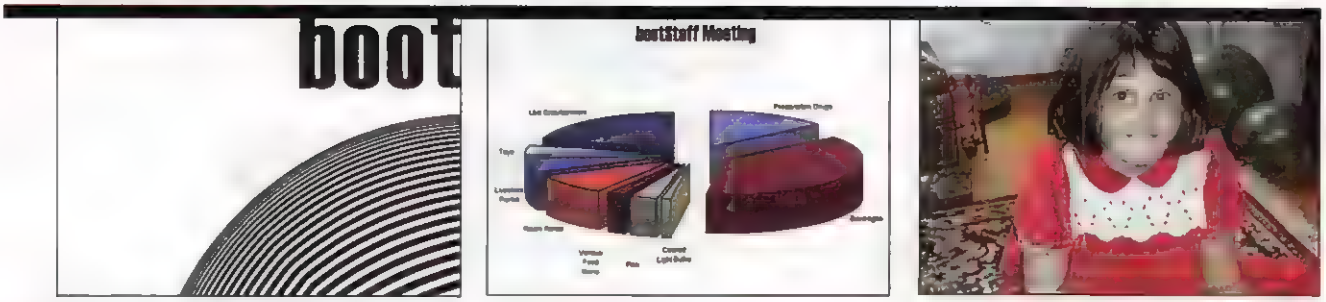
The 5L features an interesting design, with the sheet feeder and the paper tray located on the top of the printer. It looks like HP took one of their regular printers and tied up the ankles. This doesn't stop the 5L from cranking out prints at a ripping 6ppm.

The 5L is ideal for anyone who needs laser-quality printouts from a tidy little package. For printing that doesn't get soggy in milk, this fast monochrome monster is great.

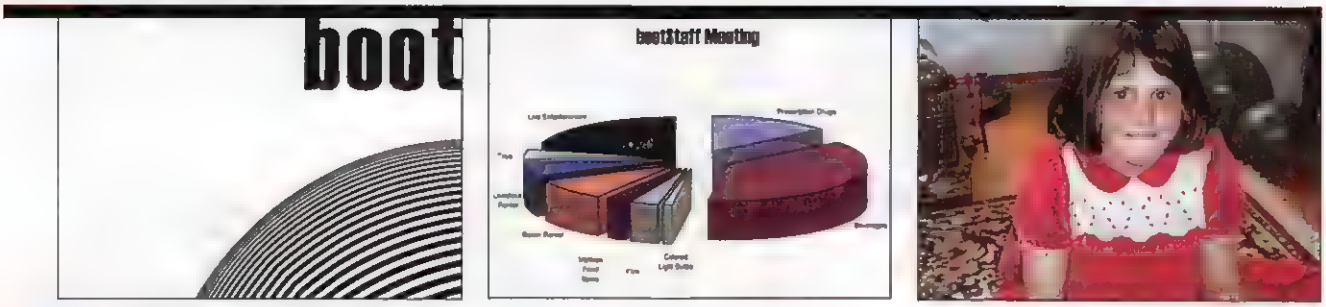
Laser
600x600 monochrome only

Print Samples

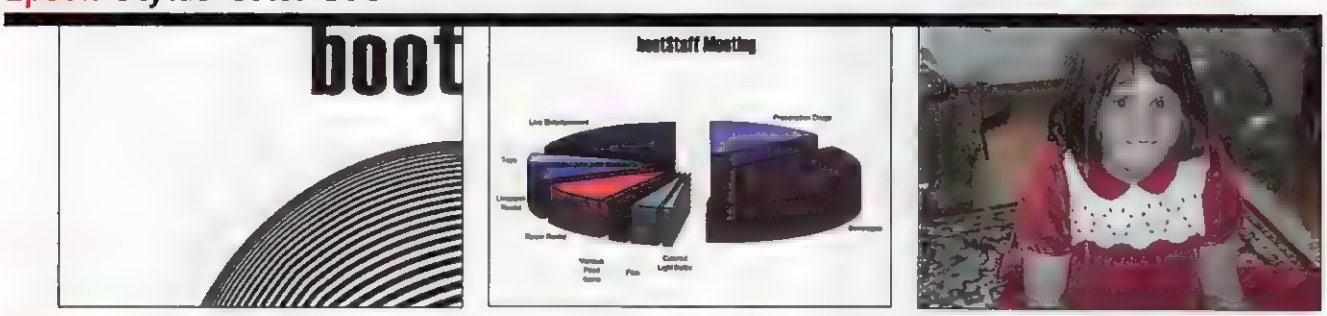
Hewlett-Packard OfficeJet Pro 1150C



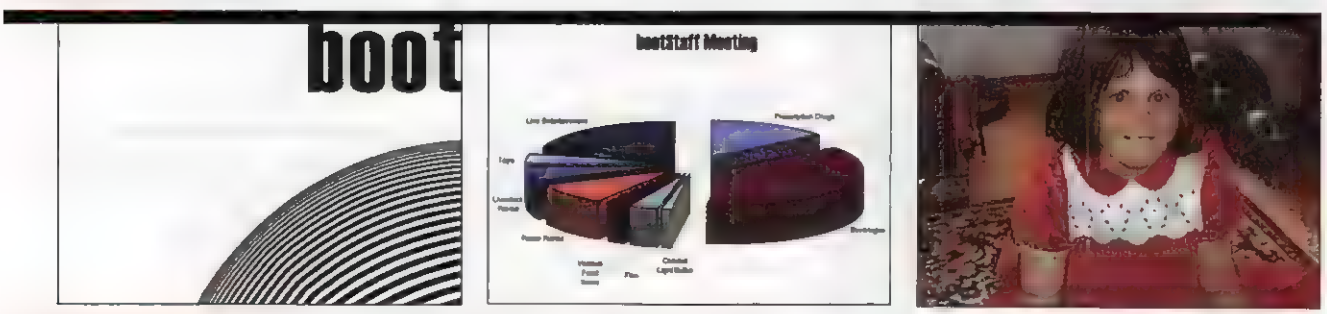
Alps Masterpiece MD-2300



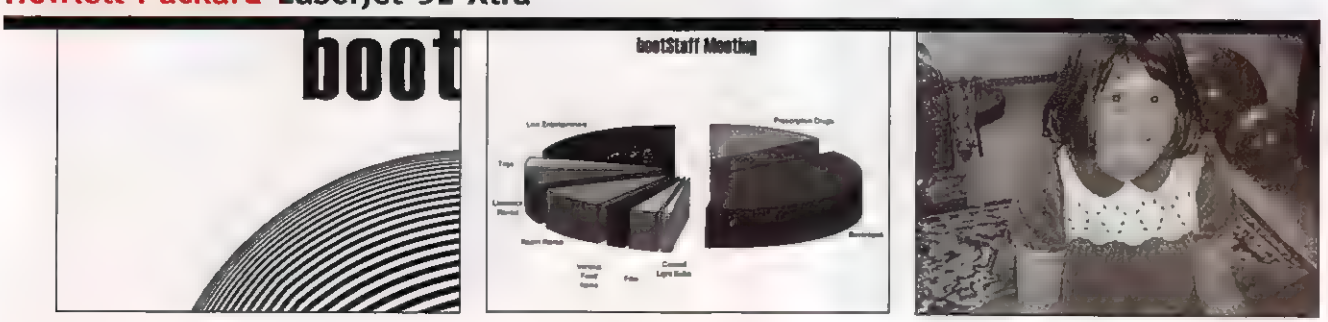
Epson Stylus Color 800



Tektronix Phaser 550



Hewlett-Packard LaserJet 5L Xtra



boot previews

HARDWARE
ON THE HORIZON AND
SOFTWARE SOON TO SHIP

58 Mobile **3D Chipsets**

61 **Age** of Empires

TITLE	DEVELOPER	DATE
Pentium P233 MMX	Intel	6/97
IF-22 Raptor	Interactive Magic	6/97
Visual Basic 5.0	Microsoft	6/97
Hexen II	Activision	6/97
Jedi Knight	LucasArts	6/97
Sierra Pro Pilot	Sierra On-Line	6/97
Birthright	Sierra On-Line	6/97
Softimage v3.7	Microsoft	6/97
Flight Unlimited II	Looking Glass	6/97
Rebellion	LucasArts	6/97
The Curse of Monkey Island	LucasArts	6/97
Electric Image	Electric Image	6/97
Descent To Undermountain	Interplay	7/97
Armored Fist II	NovaLogic	7/97
688I Hunter Killer	Janes	7/97
Flying Nightmares 2	Eidos	7/97
Outpost 2	Sierra On-Line	7/97
Swiv3D: Quad Assault	Interplay	7/97
Corel Office Pro 8.0	Corel	7/97
Deathtrap Dungeon	Eidos	8/97
NetStorm	Activision	9/97
Riven	Broderbund	9/97
VR Baseball 97	Interplay	9/97
Crusader III	Origin	9/97
Lands of Lore II	Westwood	9/97
Screaming Demons	Activision	10/97
Blade Runner	Westwood	11/97
Unreal	Epic MegaGames	11/97
The Dark Project	Looking Glass	12/97
Mask of Eternity	Sierra On-Line	12/97
Heavy Gear	Activision	12/97
10th Planet	Bethesda	12/97
Daikatana	Eidos	12/97
Anachronox	Eidos	12/97
Ultima IX	Origin	12/97
Windows 98/Memphis	Microsoft	Q1/98
MMX 2	Intel	2/98
Windows NT 5.0	Microsoft	Q2/98
Prey	3D Realms	3/98
MechWarrior III	FASA	Q2/98

*These dates are subject to change

Mobile 3D Chipsets

Taking it to the streets

In case you just tuned in, notebook PCs have closed the gap on their desktop cousins in CPU horsepower, disk speed, and most other significant features—except graphics. Notebooks can't crank hardcore pixels, and certainly not in 3D. But a new breed of mobile graphics chips looms on the horizon, promising 3D salvation. S3, ATI, and Trident all have plans in place to make sure the only thing two-dimensional about your notebook's display come late this summer is the LCD itself.

— Chris Dunphy

ATI is Raging

ATI was the first to announce a mobile 3D chip driving an LCD screen, with their 3D Rage LT—derived from the Rage II+—unveiled at Comdex last fall. ATI's mobile-product manager Azzedine Boubuira says they're working with four of the top six notebook makers, and expects Rage LT-powered notebooks to be out as soon as early this summer.

Featuring an integrated 170MHz RAMDAC, the Rage LT can drive a color DSTN panel at up to 1024x768, and TFT LCD panels at up to 1280x1024, all with 24-bit color. The LT is the first LCD controller with on-chip support for an LVDS (Low Voltage Differential Signaling) transmitter that can be used to make the interface a high-res LCD that's more robust and less prone to create RF interference. This eliminates the need for a separate LVDS encoder chip.

One common problem with notebooks is that low-res apps (i.e., most games) appear either centered on the LCD with a huge black border, or are stretched to fill the screen creating distracting artifacts. The Rage LT solves this by using ATI's video-scaling circuitry to transparently fill the entire screen, without slowdown or artifacts at any resolution. ATI's scaling technology also provides two hardware-scaled video windows, which are great for video conferencing or watching movies.

Perhaps the Rage LT's most interesting feature is its support for DVD motion compensation to allow hardware assist of software MPEG decoding. With motion compensation, a P200 MMX usually maxes out decoding MPEG-2 video and AC-3 audio at 15fps, but can manage a reasonable 21fps. The LT will use up to 4MB of DRAM, EDO DRAM, SDRAM, or SGRAM on a 64-bit memory bus, clocking the memory at up to 83MHz. As CPUs get faster and software DVD decoders optimize, this number will creep ever upward, making watching DVD movies on your lap a reality.

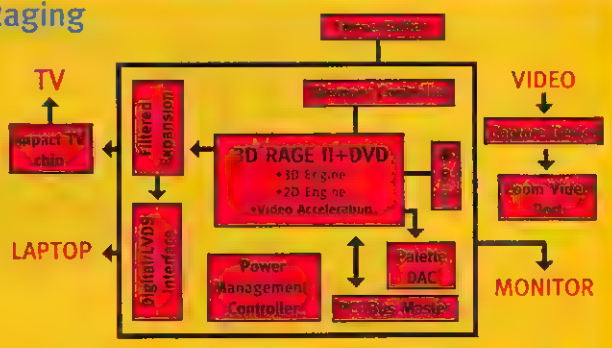
If you'd rather watch your movie on the big screen, you can pair the Rage LT with ATI's ImpactTV chip to view an 800x600 resolution—or lower—display simultaneously on a TV and an LCD.

product info

Available ***Now sampling to OEMs***
Price ***$30 (to OEMs in quantity)***
Company ***ATI***
Phone ***905.882.2600***
URL ***www.atitech.com***

Mobile Raging

ATI's awe-inspiring video playback is coming to a notebook near you. Did we mention the 3D acceleration?



S3 Has Double Vision

S3, the Godzilla of 2D, has plans to muscle in on the portable chipset turf and they have the innovative features to do it. With their third-generation ViRGE/GX2 architecture merged into the classic Aurora mobile chip, S3 aims to deliver a feature-rich, yet power-miserly, chipset. This chip, known as ViRGE/MX, is currently sampling to notebook manufacturers and will be ready for volume production soon.

ViRGE/MX's most striking feature is its ability to display different images on two screens. The technology, known as DuoView, allows you to have your notes on the LCD while displaying a presentation on a connected TV or monitor, for example. Though dual displays won't be supported at the operating system level until Memphis or NT 5.0 comes along, S3's managed to spoof Win95 into doing it now. Typically, Windows will be tricked by splitting a single 1600x600 workspace into two 800x600 screens, but with fast SGRAM onboard, each independent screen can be up to 1024x768. Even if you choose not to use DuoView to display separate images, the parallel onboard display hardware allows your LCD and monitor to display the same image, each running at its own optimal refresh rate. Before DuoView, to get simultaneous display you were generally forced to settle for a painful 60Hz refresh.

No second chip is required for the ViRGE/MX's integrated TV encoder. To ensure optimal image quality, a three-tap flicker fixer is included.

The ViRGE/MX has a slow, integrated 135MHz RAMDAC, but can use up to 4MB of EDO DRAM or SGRAM with up to an 83MHz memory bus. Baseline 1x AGP access to main memory is also enabled. TFT and DSTN LCD panels are supported, with a maximum resolution of 1280x1024 with 24-bit color.

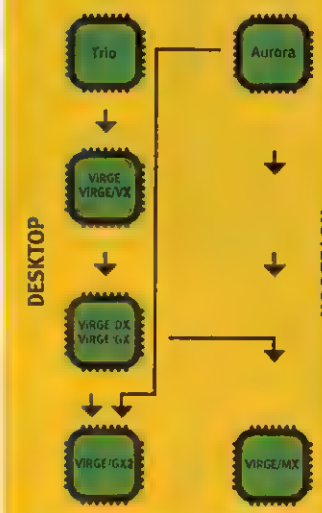
The 3D performance of the ViRGE/MX should be much improved over previous versions of the ViRGE, and, based on the ViRGE/DX boards reviewed in this issue, you can expect a good-quality video scaler.

product info

Available Now sampling to OEMs
Price $38 (to OEMs in quantity)
Company S3
Phone 408.588.8000
URL www.s3.com

The S3 Family Tree

While S3's desktop chipset has been merrily evolving. The notebook side hasn't been as active.



Who Wants Trident? I Do, I Do

Trident Microsystems is the only chip maker of this trio with a significant presence in the notebook market, and is currently battling with Cirrus Logic for second place. (Chips and Technologies holds first place.) Trident hopes to use their entrenched position as leverage to get their 3D-equipped Cyber9397 onto as many laps as possible.

Now sampling to key notebook manufacturers, the Cyber9397 attempts to cram every possible feature into a small, power-efficient package. Featuring baseline AGP for fast access to main memory, the 9397's real claim to 3D-performance glory comes from its full-on, chip-triangle setup engine. A 3D pipeline has been hard-coded into the chip's circuitry, allowing the CPU to offload much of the basic geometry calculations. Trilinear and bilinear filtering are supported, and Trident is aiming "closer to 3Dfx than ViRGE" on the scale of 3D performance.

Dual scaled-video windows at a full DVD resolution of 720x512 provide excellent movie-watching and video-conferencing capabilities, and TV-out support with an on-chip flicker fixer is provided (though the final encoder isn't integrated onto the chip in order to avoid problems adding Macrovision support for DVD copy protection).

Like the ViRGE/MX, a separate image can be displayed from the LCD and the TV outputs—a handy feature that will become invaluable once Memphis enables native OS support.

The Cyber9397 sports an integrated 170MHz RAMDAC, and supports EDO DRAM, SDRAM, and SGRAM clocked at up to a blazingly fast 100MHz. Notebooks based on this promising chip should be on the shelves by Comdex this fall.

product info

Available Now sampling to OEMs
Price $45 (to OEMs in quantity)
Company Trident Microsystems
Phone 415.691.9211
URL www.tridentmicro.com

Future Mobile 3D: Faster, Smaller, Less Juice, More Features

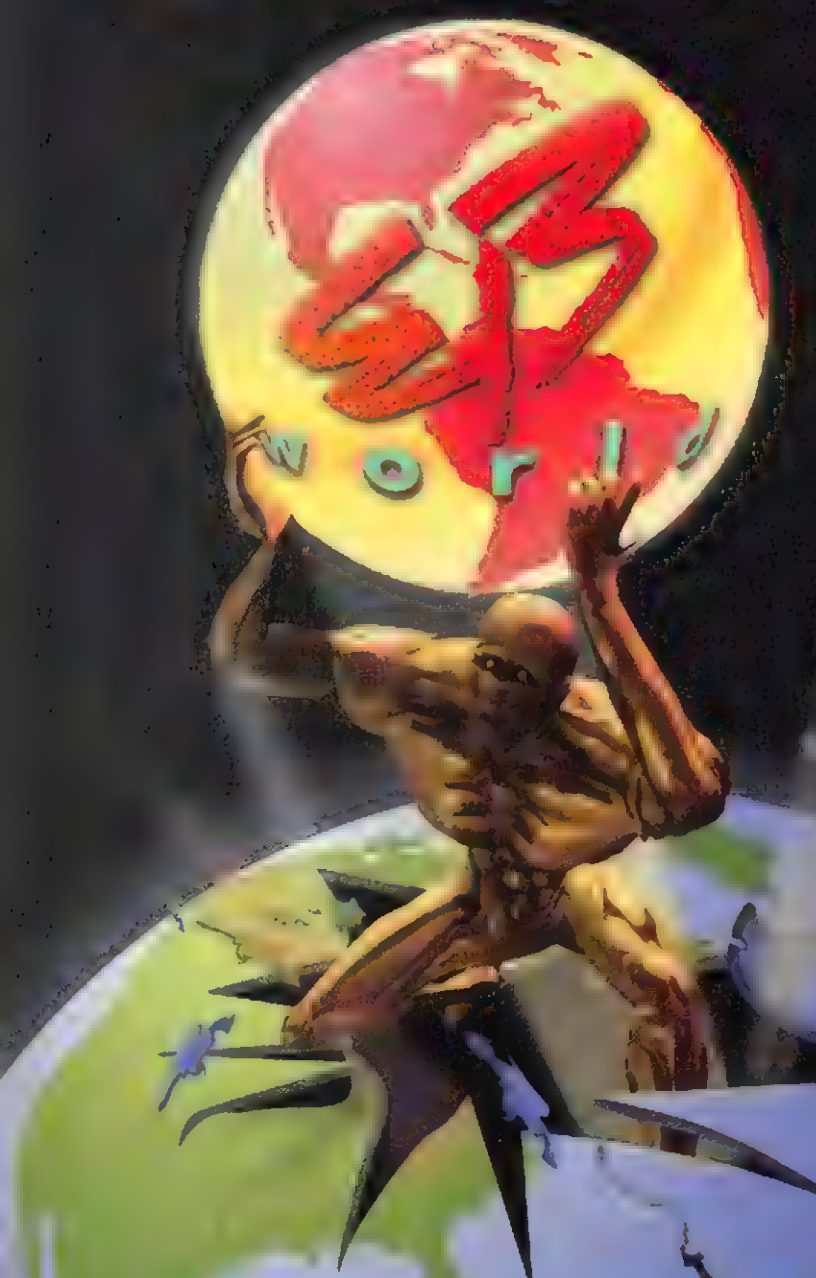
If you think these mobile 3D chips are hot, you ain't seen nothin' yet. All three mobile 3D players gave *boot* a peak at what's down the road, and you can be sure that notebooks will no longer play second fiddle to desktops when it comes to graphics.

While ATI's 3D Rage LT is essentially a mobile version of the Rage II+ DVD found in the All-in-Wonder card, by July, ATI hopes to have a mobile version of the recently announced 3D Rage Pro ready for sampling. Called the 3D Rage LT Pro, it will feature dual independent display support, integrated TV-out, a full 2x AGP implementation, enhanced MPEG-2 hardware assist, and greatly enhanced 3D performance, among other improvements.

Trident aims to start a fire with their inexpensive mobile chip called the Cyber-9388, which will complement the high-end Cyber9397. Though it lacks the 3D setup engine and raw polygon power of the 9397, the 9388 has 2MB of integrated DRAM (IDRAM) built onto the chip, giving an excellent speed at low power consumption and cost. The 9388 features basic Direct3D acceleration in hardware (but don't get excited—it's only supposed to be "around ViRGE caliber"). To be added later to Trident's mobile line, is a set of features called TAMA, which takes DVD motion compensation a step further by adding hardware assist for Dolby AC-3 audio decoding.

S3's plans also center around IDRAM, to be added to their mobile chipset by the end of the year. Also in the works from S3 is an on-chip 3D setup engine, DVD motion compensation, and an LVDS LCD interface.

There's a Whole New World in Which to Play



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Product Information Number 131

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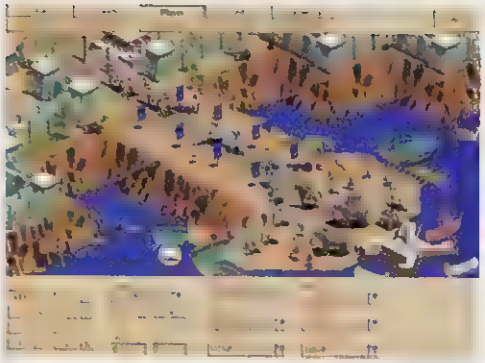
Age of Empires

Epic warfare throughout time

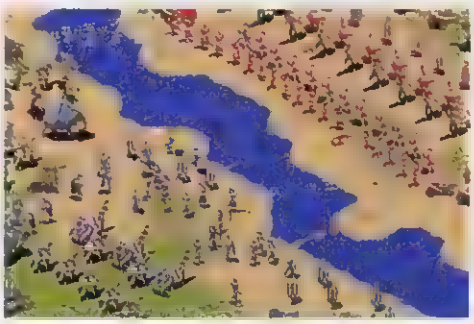


With a multitude of multiplayer features, *Age of Empires* hopes to be a hit online.

Ensemble Studios is putting the finishing touches on their first real-time strategy game, Age of Empires, *slated for release by Microsoft this fall.* ***Bruce Shelley,*** *founder of Ensemble Studios (and co-designer of* Civilization*) tells us what makes* Age of Empires *worth playing... and replaying.*

boot: What's *Age of Empires* about?
Shelley: It's a real-time strategy game set in ancient times where the player controls one of 12 historic cultures, such as the Egyptians and the Assyrians. It's Ensemble's first project and we incorporated the best features of games we particularly enjoyed. Early in our development we focused on primitive history, but the addition of Asian cultures, especially ancient Japan, moved *Age* past the B.C. years.
boot: What kind of gameplay can we expect?
Shelley: *Age* is similar to other real-time games, but it emphasizes building your city/empire, acquiring technology, and economics. Conquest mode will probably be the most popular, but through adjustable economic settings and victory conditions, it can be played more as a building/resource management game.

Multiplayer (up to eight players by modem, network, or Internet) and solitaire (randomly generated games against up to seven computer opponents; predesigned scenarios; historical campaigns of linked scenarios) play are supported, and we're including a comprehensive scenario editor.
boot: Will the game appeal to everyone or just hardcore strategy fans?
Shelley: *Age* will definitely appeal to hardcore gamers. Most of our staffers are hardcore and we really get into multiplayer network games. At the same time, adjustable victory conditions and levels of difficulty will allow everyone to find a style and challenge that suits them.
boot: What's a player have to do to win the day in *Age*?
Shelley: At the start of any randomly generated game the player sets the victory conditions. Victory can be determined by the player's extent of map exploration, capture of map features, resource acquisition, population, technology achievements, and other variables.



Control one of 12 historic cultures and conquer the world by battling on land and on sea.

Multiplayer games typically involve the elimination of all other players. The scenario editor allows more complex victory conditions, such as capturing specific objects, destroying specific objects, and reaching a certain age (Bronze Age or Iron Age, for example). With it, relatively peaceful exploration, empire building, and resource management games can be played, rather than just conquest games.

boot: How many hours of gameplay do you foresee?
Shelley: With its excellent configurable AI and randomly generated games, *Age* will be endlessly replayable. It comes with at least 40 to 50 scenarios, plus the randomly generated games.
boot: Are any new technologies used in the game?
Shelley: We built a data-based graphic engine, which we hope to leverage over several products. This turned out to be a huge undertaking, but it works extremely well now. All game objects in our 2D isometric view were built and rendered using *3D Studio Max.* Despite all the moving 3D objects and the complex database, we're very pleased with the frame rates we're getting with optimization.
boot: Randomly generated games for solitaire players depend on a good AI to be successful. What makes the AI in *Age of Empires* superior?
Shelley: One of our major goals was to make the randomly generated solitaire game outstanding, since we believe that about 80 percent of gamers play predominately solo.

Our strategic AI is controlled by more than 100 variables and does not cheat. It searches the map and responds to what it finds... just like the player. The player can adjust some of these variables to make it more or less aggressive, more or less expansive, more or less defensive, etc. The goal is to make gamers sweat, but generally win, if they're experienced. If they are never challenged or never win, they won't be satisfied. Great AI means the game is endlessly replayable.

Age of Empires features multiple victory conditions including map exploration and resource acquisitions.

product info

Available *Fall 97*
Price *TBA*
Developer *Ensemble Studios*
Publisher *Microsoft*
Phone *800.426.9400*
URL *www.microsoft.com/games*

Create and Breed Your Own Artificial Life

creat

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ENTERTAINMENT

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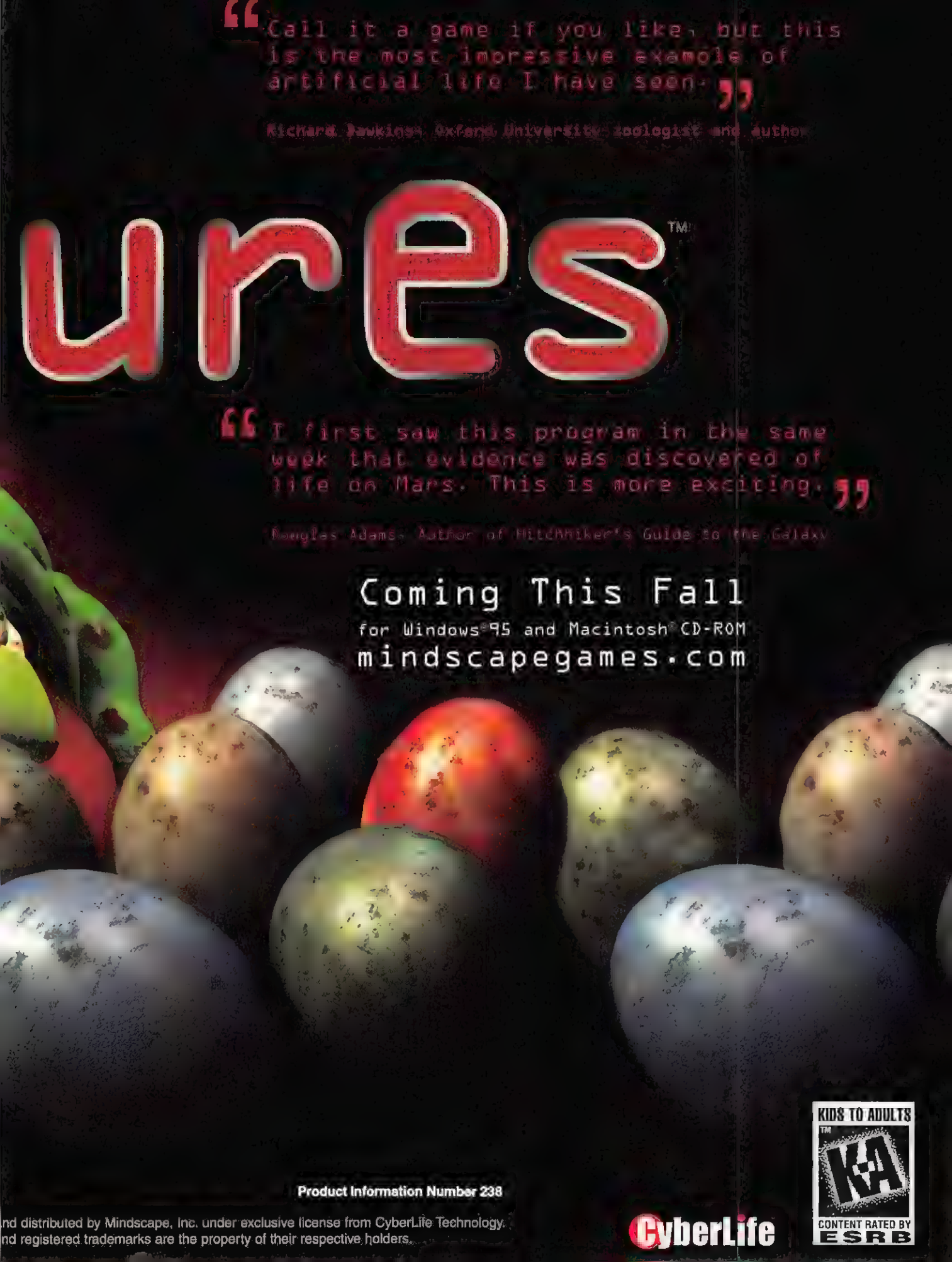
"Call it a game if you like, but this is the most impressive example of artificial life I have seen."

Richard Dawkins, Oxford University zoologist and author

ures™

"I first saw this program in the same week that evidence was discovered of life on Mars. This is more exciting."

Douglas Adams, Author of HitchHiker's Guide to the Galaxy



Coming This Fall

for Windows®95 and Macintosh® CD-ROM

mindscapegames.com

KIDS TO ADULTS

CONTENT RATED BY ESRB

Product Information Number 238

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CyberLife

boot reviews

KICKIN' THE TIRES ON THE LATEST **HARDWARE** AND TAKIN' THE NEWEST **SOFTWARE** OUT FOR A SPIN

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DVD Deliverance

Storage salvation on a shiny, silver disc

Creative Labs' PC-DVD and HiVal's DVD System are the first complete DVD-ROM kits to hit the bootLab. Each is a gateway to ultra-fast 24fps MPEG-2 video and the 17GB world of DVD. But don't chuck your CD-ROM drive just yet, because, like a good dominatrix, DVD's pixel-pushing pleasure is laced with a little pain.

— Andrew Sanchez

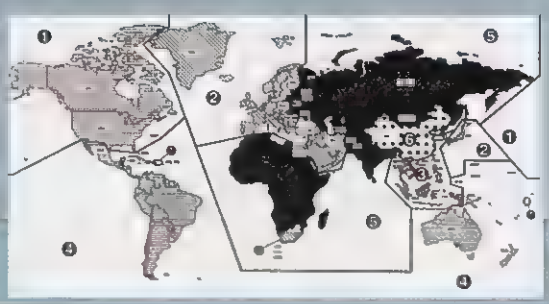
It's finally in our hot, sweaty hands. DVD makes us feel like French-kissing our neighbors! But how long will the euphoria last?

Components

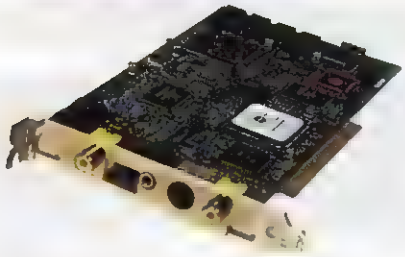
Creative's PC-DVD is made up of Panasonic/Matsushita's SR-8581 EIDE DVD-ROM drive armed with a 128K buffer and their MKE-DVD-AV PCI decoder board. Housing both the MPEG-2 decoder and Dolby AC-3 circuitry, the DVD decoder card is huge! Make sure your system can handle a full-length PCI card before purchasing this baby. The card's many input and output ports include analog and Dolby digital audio output, plus an input connector. An extra EIDE ribbon

What DVD, the Wedding's Big Picture Was?

Think twice before buying DVD hardware or discs at that discount outlet in New York or Hong Kong or anyplace requiring a long-distance phone call. To "protect their markets" (and confuse consumers), DVD discs are encoded so they only play on DVD players native to the manufacturer's region. With the world divided into six regions, this zoning restricts specific software to a region, thus ensuring that native DVD products won't have to compete with foreign discs.



Not all DVD titles will have this coded protection, but most will.



With faster CD-ROM performance, a slick interface, and tons of features, the HiVal DVD System is a solid, albeit pricey, deal.

cable and ⅛-inch mini stereo cable are also included.

The MKE-DVD decoder card feeds your video card output into the decoder, which spews the overlayed output to your monitor. Unfortunately, there are no S-video or composite video outputs for viewing NTSC video. "But what if I have an ATI video card with TV output?" you cry. Sorry. Feeding your TV that juicy new DVD video is not to be, because the video card runs into the MPEG-2 decoder card and the overlay is last in the video chain.

Unlike the steroid-induced Creative card, HiVal's DVD System—based on Toshiba's 256K-buffered SD-M1002 DVD-ROM EIDE drive with the Quadrant International Cinemaster PCI MPEG-2 decoder card—doesn't require a full-length PCI slot, nor does it employ a pass-through connector. HiVal's DVD System interfaces via their PCI bus-mastered process called Video-Inlay. Also, Quadrant's card comes armed with both S-video and RCA video output so you can plug this bad boy into your television and enjoy the DVD experience in 30(+) inch splendor. One-eighth-inch mini plugs shoot the audio out to your receiver or sound card. Software pack-ins include Virgin's *The Daedalus Encounter*, Tsunami's *Silent Steel*, Activision's *Muppet Treasure Island* and *Spycraft*, Origin's *Wing Commander IV*, and Xiphius' *Encyclopedia Electronica*.

Installation

Both PnP systems are a snap to install, but alternate OS users will be steamed. Win95 is the only operating system that Creative's kit will run on. If your AUTOEXEC.BAT file isn't located in the hard drive root directory, the install will fail. Copying the AUTOEXEC.BAT over to the Win95 drive solves this problem. The SCSAV card takes up one IRQ and one hex address location (6200–623F).

HiVal's kit installs without a hitch. The Win95-only drivers slide in effortlessly, with the Cinemaster taking up an IRQ and a memory range of E2001000–E2001FFF.

Once you feed your machine the proper drivers, a glance at your System Control panel reveals your bus-mastering DVD drives lurk within your CD-ROM hardware listing, and your decoder cards reside within your Sound, Video, and Game Controller listing. Also included with both kits is a DVD video player, allowing instant access to DVD-video CDs.

Whatever you do, don't feed your DVD drive any CD-R discs. Due to DVD's new laser mechanisms, attempting to access any CD-R will damage the disc, possibly corrupting the data and rendering the disc useless. You've been warned.

The Tests

Until more DVD-ROM games become available (see sidebar on this page), you'll be spending most of your DVD quality time watching movies.

While MPEG-2 hardware decoding ensures a rock-solid 24fps video playback in 64K colors, results vary widely depending on the quality of the MPEG-2 compression used on the movie and your decoder card. After testing early releases, such as *Twister* and *Eraser*, we have this advice: Don't expect "better than laserdisc" quality.

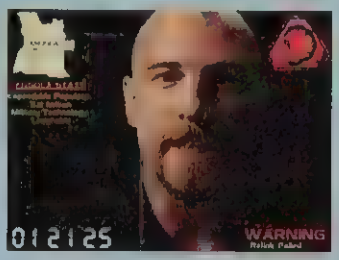
Under close scrutiny, the Creative combo suffered. The close-up of Schwarzenegger's boots during the *Eraser* intro had diagonal lines looking jagged and pixelated, and maximizing the viewing field resulted in horizontal lines flaring on fast-moving objects. It just goes to show that you never get something for nothing—compression always costs. Luckily, the artifacts disappeared when we minimized the window size.

The PC-DVD also choked on screen resolutions greater than 800x600. Tweaking the overlay settings is your only recourse and you may have to drop your refresh rate to sync the video playback correctly.

The HiVal system, in contrast, pumps red-hot MPEG-2 pixels with authority.

Someday, some game developer will use those GBs for actual game data, rather than tons of flaccid FMV. But, as expected, FMV plays a big part in which games make the initial jump to DVD. Here's a sampling of what to expect:

***Wing Commander IV*: Origin's epic continuation of the great space combat—and no more CD swapping!**



***Command & Conquer*: Westwood's classic real-time strategy game. Kane never looked better!**

***Spycraft*: Activision's simulation of high-level espionage enters the realm of DVD, with crisp video and some new tricks up its sleeve.**

Eraser's boots appear smoother on the Cinemaster card, and diagonal lines don't pixelate as much. The artifacting that stifled the Creative system also rears its ugly head here, but to a lesser degree. HiVal's DVD System handles higher graphics resolutions and refresh rates much more elegantly than Creative's system—we were able to run movies at 1024x768 at 75Hz without modifying any settings.

Sound comes crashing through like a rhino on both systems. Room-shaking explosions and the staccato sting of gunfire brings the theater experience home, thanks to some serious dynamics and extended frequency response. You'll bring the house down if your PC's hooked up to a mega-watt receiver and some bumpin' tower speakers, but with a typical half-baked excuse for multimedia sound you'll never experience the 30Hz thrill.

Wireless Woes

If you really feel the need to flex your super-pimpness, HiVal offers an even pricier DVD kit complete with RF-Link's Wavecom Sr. Wireless Audio Video Communicator. Feed your DVD output into the antenna-armed receiver and fire its 2.4GHz signals into the receiver, which pumps the signal to your TV—even if the units are in separate rooms!

Installation is a snap and the product works as advertised, albeit with a faint hiss during quiet passages. Sonic dynamics are snappy and responsive, while the video quality is crisp (TVs are more forgiving with pixelation). We ran into occasional bursts of on-screen static and interference, though.

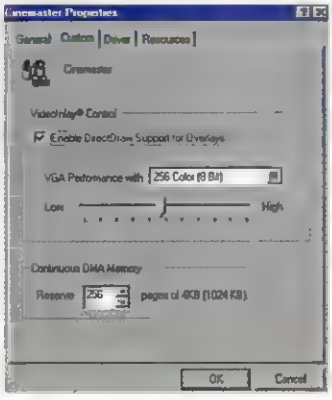
Software

PC-DVD's movie player looks like a bulky Reagan-era VCR and is in sore need of a facelift. It lacks basic features, such as a rewind button. DVD can't play backward, and jumping back to bookmarked spots in a movie is a drag.

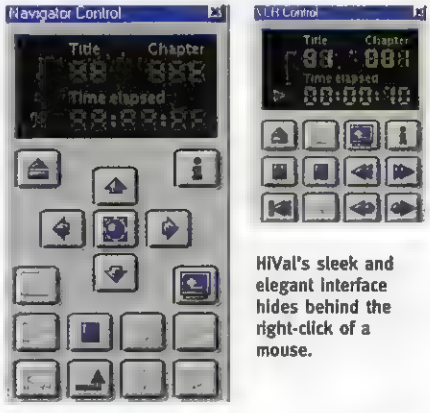
Sure, all your settings and programmability can be accessed from the menus, but the package isn't elegant. Entering the DVD-movie menus and taking a peek at all the extras, such as movie trailers and actor bios, becomes a chore with the sparse pop-up windows armed with hard-to-follow keypad and arrow buttons. Obviously, the system was designed for a hand-held remote, but a clearer interface would be easier to follow.

Clumsy and ugly, Creative Labs' movie player interface needs a complete overhaul. You can't even rewind!

HiVal's movie player interface, on the other hand, hides behind the scene. When launching this player you may think something's amiss—the movie starts sans gaudy menus. Right-clicking anywhere on the screen pulls up the first menu, from which you can launch into smaller applications. Pull up the VCR controls and you have access to movie controls, including rewind! The interface is clearer and more intuitive than that of the PC-DVD.



With the Cinemaster, DMA buffer control and more are an applet away.



HiVal's sleek and elegant interface hides behind the right-click of a mouse.

The Call

DVD's birth is bound to scar. Creative Labs' PC-DVD shows the stretch marks, with a clumsy software interface and a humongous PCI card to prove it, while HiVal's DVD System is a solid, albeit pricey, solution. Labor pains aside, DVD is a promising progeny for the PC's bright future.

If you don't plan to buy a stand-alone DVD player, this is a viable alternative. But $999 for the DVD System/Wavecom Sr. Combo is a pretty penny to pay.

Product *Creative PC-DVD*
Price *$499*
Company *Creative Labs*
Phone *800.998.1000*
URL *www.creativelabs.com*

Product *HiVal DVD System*
Price *$799*
Company *HiVal Inc.*
Phone *714.953.3000*
URL *www.hival.com*

Can't Get Rid of That CD-ROM Yet?

Thinking of tossing your CD-ROM drive? Check out how these DVD drives perform.

CDTach Pro v1.65 Test	Panasonic	Toshiba
16K average transfer rate (K/sec)	904	1200
Random access time (ms)	161	123
CPU utilization/speed	21% / 6x	28% / 8x
Type of CD-ROM drive	CLV	CLV
Comparable CD-ROM speed	6x	8x

Sound Forge 4.0a

Hammer out some new noise

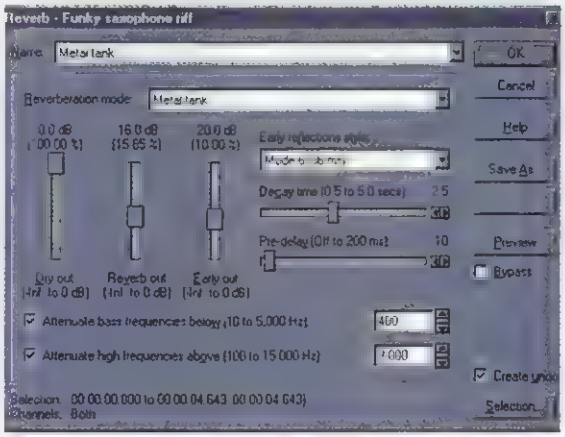
Sonic Foundry's *Sound Forge* has been the two-channel audio editor in Windows for some time, and the recent 4.0a release does nothing to diminish its standing.

New features include Direct Edit, where you edit a file on disk, instead of in RAM, to speed the opening and saving processes; reactive previewing for tweaking effects and hearing your revisions; multilevel undo/redo and an undo/redo history showing all previous states of a file; improved time compression/expansion and pitch shift; a four-band compressor/limiter; paragraphic EQ; and the ability to send and receive SMPTE/MIDI time code to synchronize recording to video.

For web development, *Sound Forge 4.0a* can save files as RealAudio, Java, or AU, and save its own and AVI files in Microsoft's Active Streaming Format. Any of these can be used without further modification to stream audio or video across the web.

Version 4.0a will "attach" an AVI video file to a sound file, displaying the video in a series of frames, each playing in succession as the audio plays. (See screen shot below.) This helps to edit audio synchronized to video.

The feature that may please the most people is the new reverb algorithm. Limited reverb has always been *Sound Forge*'s Achilles' heel, but the new version offers studio-quality reverb, at least for multimedia and project studios. The effect has a smooth and pleasant sonic quality, and an impressive set of controls offering 19 presets or controls for sculpting a host of parameters: individual volume controls for dry signal, effect signal, and early reflections; decay time (from 0.5 to 5.0 seconds); pre-delay (from 0ms to 200ms); bass and treble attenuation (from 10Hz to 5000Hz and 100Hz to 1500Hz respectively); 10 early-reflection modes; and extensive controls for adjusting the effect's timing within the file.



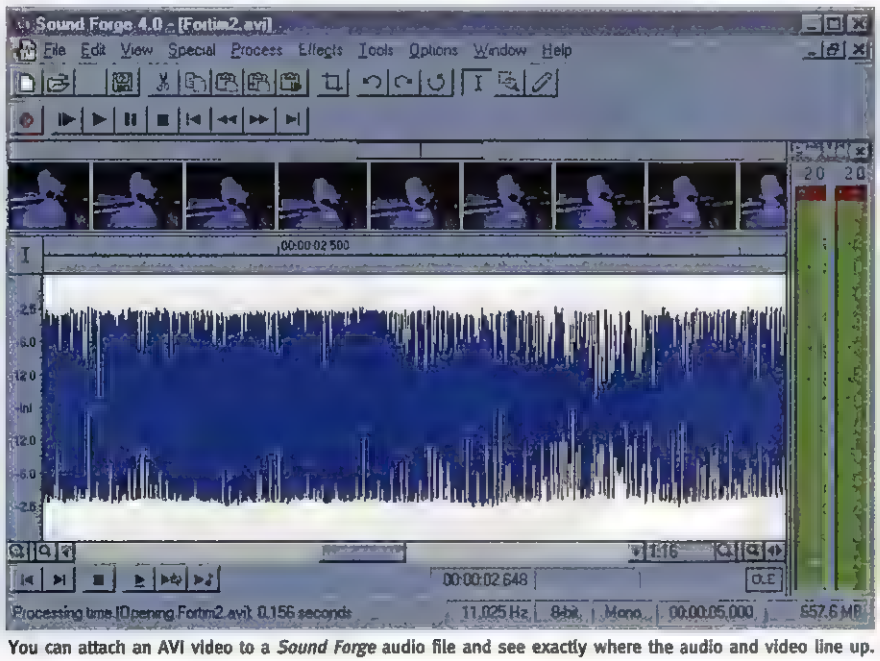
***Sound Forge 4.0a*'s Reverb effect can be customized in many ways.**

Sound Forge can run simultaneously with a MIDI sequencer and outputs MIDI Time Code to sync a sequencer to its audio. Regions (see sidebar above) can be triggered by MIDI events or MIDI time code.

The program supports Microsoft's ActiveMovie architecture, so the effects of any ActiveMovie plug-ins can be changed in (almost) real time. Companies such as Waves and QSound are already offering ActiveMovie plug-ins, and the program can use ActiveMovie plug-ins written for any application.

The new release of *Sound Forge* has a nondestructive Cutlist that lets you instantly delete a selection from playback without affecting the file on disk, and bring it back later. This is great for creating different versions of performances, especially saving time where long sections are involved.

If you use digital audio professionally, you're probably already familiar with *Sound Forge*, and version 4.0a improves on an already solid product. — *Tim Tully*


Sound Forge 4.0 - [Fortim2.avi]
File Edit View Special Process Effects Tools Options Window Help
00:00:02.500
00:00:02.648
Processing time [Opening Fortim2.avi]: 0.156 seconds
11,025 Hz 8-bit Mono 00:00:05.000 857.6 MB

You can attach an AVI video to a *Sound Forge* audio file and see exactly where the audio and video line up.

Price $495
Developer Sonic Foundry
Publisher Sonic Foundry
Phone 800.577.6642
URL www.sfoundry.com

Tempting Power Sounds

Any application in which you need sound—narration, music, and sound effects—can be helped by *Sound Forge*'s flexible features. Developing a soundtrack for a video, for instance, or for streaming audio on the web are perfect.

One way *Sound Forge* can help extract the good parts from a lot of bad tries at a narration is the playlist. You can select any portion of a file—a region and add it to a playlist in which you can arrange regions, edit their lengths, and set each to play any number of times in any order. This gives you great production flexibility without affecting the file on disk.

NEC PowerPlayer 3020

One step forward, two steps back

To earn our respect, a computer can make very few compromises. The PowerPlayer 2020 was such a system, earning *boot*'s first Kick-Ass award for a desktop system. It managed this by pushing the limits of how much good stuff can be crammed into a single box.

Six months later, the new PowerPlayer 3020 delivers MMX and other improvements over its predecessor, but it takes too many steps backward. It's still a great system, and at a much lower price than the 2020, but it's lost its edge.

In some cases the trade-offs are even—the nifty 6x4 CD-ROM changer was replaced with the fastest 16x drive we've seen. But NEC deleted the IrDA port and matching wireless mouse, and they've chopped the software bundle in half. Only *Pod* effectively shows off the power of the 3Dfx Voodoo accelerator, and the only other really compelling title in this package is *You Don't Know Jack*.

Still, this PowerPlayer has better sound at the expense of one fewer free slots. As for swapping out the Gravis GrIP game pads for Microsoft SideWinders... that's just a matter of taste.

The PowerPlayer 3020's performance is a mixed bag. The I/O speed was off our charts, with that blazing fast CD-ROM and a hard drive that posted more than 4MB/sec throughput. But overall benchmarks were hampered by only 256K of cache (not expandable), resulting in average overall performance. The on-motherboard ATI Rage II is no speed-demon, but it's fast enough for most 2D work and it's scaled video is unbeatable for watching MPEG movies. ATI's AMC connector is provided on the motherboard for adding a TV tuner or other goodies, and the onboard graphics memory is upgradable to 4MB for better performance and higher resolutions.

The PowerPlayer 3020 may not be the ultimate PC by today's standards, but there's still a lot to be said for a big box packed with goodies. Just think of this machine as the ultimate console game system, at about 15 times the cost.

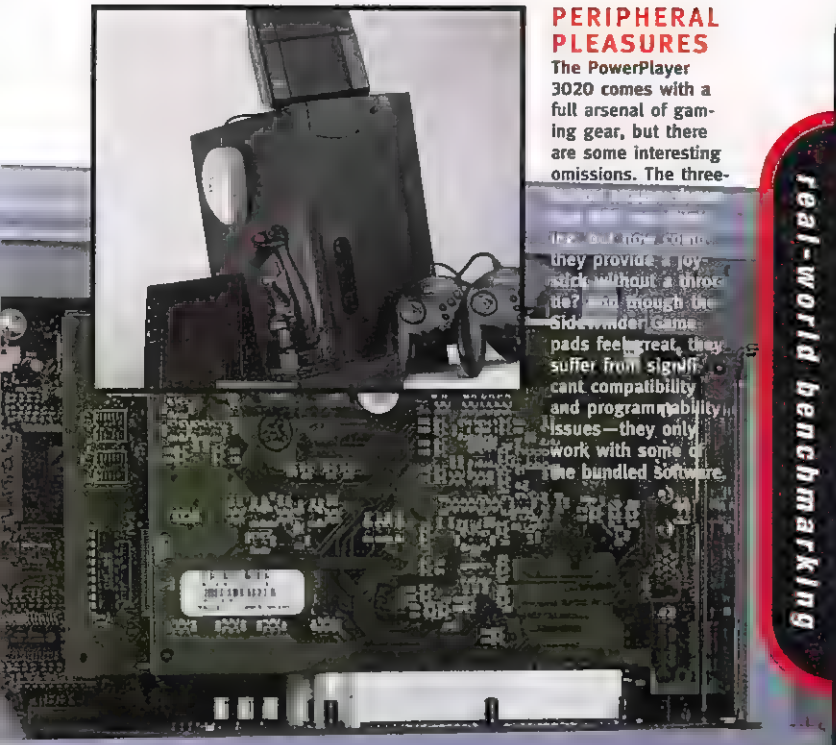
— *Chris Dunphy*

under the hood

THE BRAINS	
CPU	Intel Pentium 200MHz MMX (P55C)
L2 Cache	256K pipeline burst cache
RAM	32MB EDO DRAM (128MB max)
Motherboard	Proprietary NEC LPX formfactor
THE BRAWN	
Video	ATI 3D Rage 2 w/2MB EDO DRAM (on motherboard, expandable to 4MB), Diamond Monster 3D w/4MB EDO DRAM (3Dfx Voodoo)
Hard Drive	4GB Quantum Bigfoot
CD-ROM	NEC 16x CDR-1600A
Expansion Bus	Three PCI slots (one occupied); three ISA slots (two occupied); one PCI/ISA shared
Fax/Modem	BOCA 33.6Kbps fax/modem with full duplex speakerphone; DSVD upgradable
I/O Ports	Two USB, one serial, one parallel
THE BEAUTY	
Display	Not bundled
Sound	Creative Labs AWE32
Speakers	Advent AV370 (two 10W satellites, 30W subwoofer)
Other	ThrustMaster Top Gun joystick, two Microsoft SideWinder Gamepads, three-button Logitech Mouse

THE BUNDLE Pod (MMX, 3Dfx) ▮ Eraser (MMX) ▮ Descent II – Destination Quartzon (3Dfx) ▮ You Don't Know Jack ▮ VR Soccer (3Dfx) ▮ Battle Arena ToShinDen (3Dfx) ▮ TEN pack (shareware Dark Sun, Duke Nukem 3D, and Necrodome) ▮ Microsoft Return of Arcade ▮ MS Works ▮ MS Money ▮ MS Encarta 96 ▮ MS Publisher ▮ McAfee VirusScan

boot up :48 | down :9



PERIPHERAL PLEASURES

The PowerPlayer 3020 comes with a full arsenal of gaming gear, but there are some interesting omissions. The three-

they provide a joystick without a throttle? Sure enough the Sidewinder Game pads feel great, they suffer from significant compatibility and programmability issues—they only work with some of the bundled software.

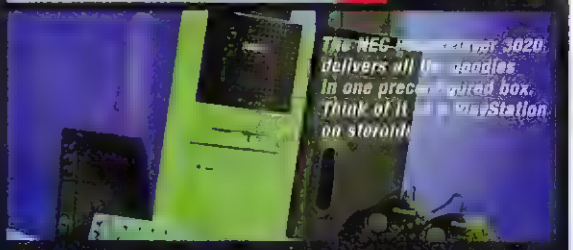
SOUNDS GOOD, LOOKS GREAT

3D oomph.

real-world benchmarking

NEC PowerPlayer 3020

CPU/MOTHERBOARD	bootMark	49
WIN95 APPS	SYSmark32	186
DIRECT 3D	Terramark	composite 833
HARD DRIVE	Adaptec ThreadMark v1.0	MB/sec 4.56
CD-ROM	CD Tach/Pro v1.65	K/sec 2151
WIN95 VIDEO	VidTach v1.52	% played 36
DOS GAMING	Quake v1.06	fps 13.1
DIRECTX GAMING	MDK PerfTest v1.4	89
MMX PROCESSING	DeBabelizer Pro	secs 372
CPU/DISK	Microsoft Visual C++ compile	secs 220



The NEC [illegible] delivers all the goodies in one precured box. Think of it [illegible] on steroids.

+

- Awesome Advent satellites/subwoofer
- Blazingly fast CD-ROM and hard drive speed
- 3Dfx Voodoo chip
- Easy access motherboard/case
- Motherboard graphics memory expandable to 4MB
- All-in-one packaging

−

- Funky motherboard/case
- No IrDA port
- Only two free slots
- Only 256K of cache, not expandable
- Weak software bundle

Price $2,599
Company NEC Technologies
Phone 888.306.4636
URL www.nec.com

boot verdict 8

A complete breakdown of benchmark results is available on the *bootNet*. Point your browser to www.bootnet.com

3D Plus 2D Equals 5D

Kick-Ass 3D goes 2D/3D

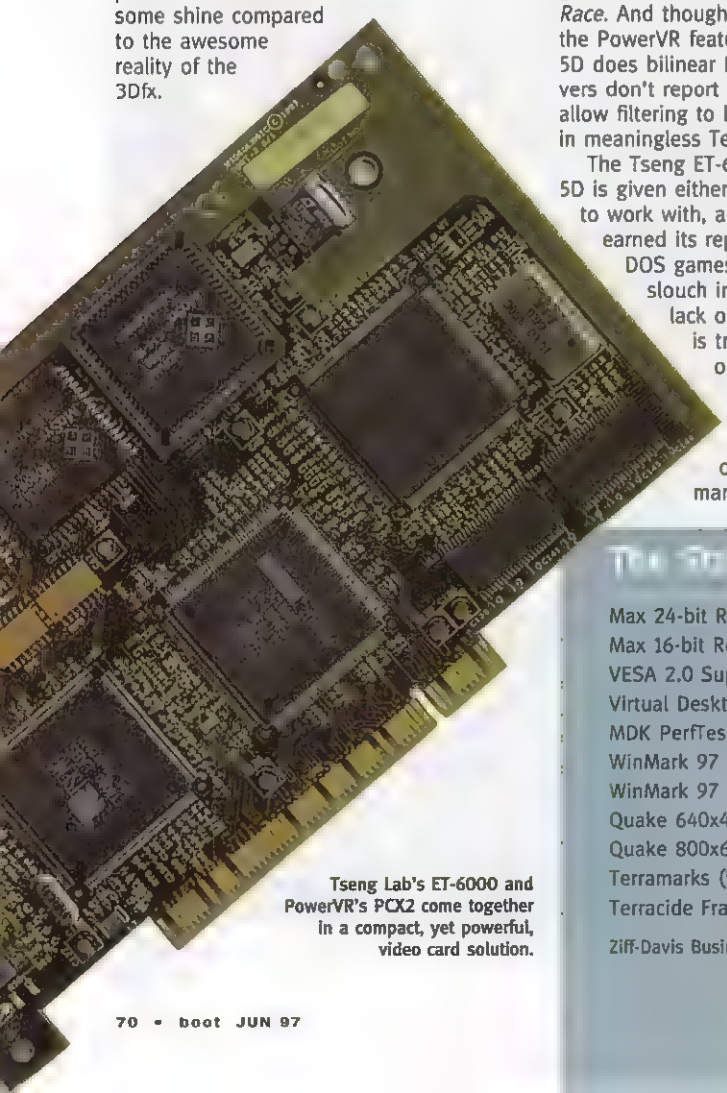
The hottest 3D cards today are based on the 3Dfx Voodoo and the PowerVR PCX2. Still, they're 3D-only chipsets. Each needs a 2D partner, and until now, if you wanted this polygon power in your system you were forced to tie up two slots and keep your 2D Window shuffler handy. Only the Rendition Vérité comes close to providing great 2D and 3D in one package, but "great" in this case isn't "greatest," and hardcore 3D junkies won't settle for less.

For ultimate all-in-one 2D/3D action, both the 3Dfx and the PowerVR camps have come out with boards featuring their chips paired with an equally hot 2D chip—and they both rock.

— Chris Dunphy

VideoLogic **Apocalypse 5D**

Both halves of this card have separately earned *boot*'s Kick-Ass award. The 2D Tseng ET-6000 chip showed up in the excellent STB Lightspeed 128 last fall, and just last month the PowerVR-based Apocalypse 3D received our nod of approval. With this heritage, the Apocalypse 5D would appear to be a slam dunk, but head-to-head with the Stingray, the promise of PowerVR loses some shine compared to the awesome reality of the 3Dfx.



Tseng Lab's ET-6000 and PowerVR's PCX2 come together in a compact, yet powerful, video card solution.

With 4MB of dedicated SGRAM for textures and no need for a Z-buffer, the PowerVR has a heap of raw 3D potential. But there's a catch. Because it's based on a nontraditional 3D model of planes rather than polygons, software that's not specifically designed for PowerVR suffers. The beta Direct3D drivers our review unit came with handled older titles fine, but struggled with new releases such as *Moto-Race*. And though the PCX2 version of the PowerVR featured in the Apocalypse 5D does bilinear filtering, the Direct3D drivers don't report this and, in fact, don't allow filtering to be turned off, resulting in meaningless Terramarks numbers.

The Tseng ET-6000 on the Apocalypse 5D is given either 2MB or 4MB of MDRAM to work with, and it flies. The ET-6000 earned its reputation as the ultimate DOS games accelerator and is no slouch in Windows either. The lack of high-resolution support is troubling, but the quality of the video scaler is better than most.

If this board ever gets its Direct3D compatibility and performance up to snuff, it has the potential to be a gamer's dream. But with NEC funneling $16 million into subsidizing developers creating PowerVR-native titles, this shortcoming may not be painful for long. The potential is there, but the jury's still out.

PowerVR's PCX2 can fulfill all your bilinear texture-mapped polygon needs.

Product *Apocalypse 5D*
Price *$279 (as tested w/ 8MB; $249 6MB version)*
Company *VideoLogic*
Phone *800.578.5644*
URL *www.videologic.com*
Bundle *Wipeout XL, Resident Evil, Ultimate Race, MechWarrior*

boot verdict 8

	Apocalypse 5D	Stingray 128/3D
Max 24-bit Resolution/Refresh	1024x768x24x70Hz	1152x864x70Hz
Max 16-bit Resolution/Refresh	1280x1024x60Hz	1600x1200x60Hz
VESA 2.0 Support	Yes	No
Virtual Desktop Support	No	No
MDK PerfTest	96	96
WinMark 97 10x7x16	69.7 / 27.1	54.7 / 24.5
WinMark 97 10x7x24	54.6 / 23.4	33 / 15.9
Quake 640x480	16fps	Failed
Quake 800x600	10.5fps	Failed
Terramarks (L1, L2, L3)	No valid results	335, 335, 331
Terracide Frame rate	10fps / 40fps	40fps / 60fps

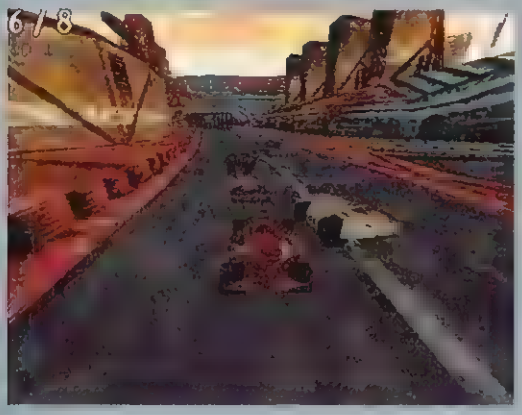
Ziff-Davis Business Graphics WinMarks / High-end Graphics WinMarks

3Dfx has the brute-force rendering architecture straight from the arcades and support from all the hottest games. PowerVR has an innovative architecture that scales well to higher resolution, costs a lot less, and has the backing of NEC's infinitely deep pockets to fund great game conversions.

So, which 3D card should you buy?

Clearly, 3Dfx has the advantage right now. Their mature drivers run circles around PowerVR for Direct3D support, and there are a lot of very impressive native titles in the works. But as *Ultim@te Race* demonstrates, native-PowerVR games have the potential to be jaw-dropping, and aside from being cheaper, all PowerVR boards have twice the texture memory of 3Dfx cards.

But it won't be a two-horse race for long. Rendition is readying the next generation of 2D/3D Vérité, and ATI's third-generation Rage is aiming to deliver "3Dfx-caliber" performance.



Pod **on the 3Dfx flows like liquid into your eyes at 60fps, while *Ultim@te Race* on the PowerVR dazzles at 800x600 with gorgeous atmospheric and lighting effects. It's a matter of taste which one you prefer, but these visuals leave every other racing game in the dust.**

Hercules **Stingray 128/3D**

The Stingray is the first card to be powered by 3Dfx's new Voodoo Rush chip. The Rush costs less than the original Voodoo, sacrificing the PCI bus interface and display generation circuitry to rely on a tightly coupled 2D chip instead. According to 3Dfx, the Rush should offer no performance boost over the original Voodoo, but our slew of apps and tests show this to be the fastest Direct3D card we've seen, coming in ahead of the Orchid Righteous 3D and Diamond Monster 3D. And thanks to the shared frame buffer, the Stingray can accelerate 3D in a window—something those two other cards never could.

The Stingray has 4MB of EDO DRAM frame buffer and 2MB of texture memory on separate memory buses for parallel access speed. With twice the frame buffer of the other Voodoo cards, the Stingray has the memory to run games that use a Z-buffer at 800x600, but according to 3Dfx, they are discouraging developers from supporting these modes to prevent "confusion" across the product line. We can only hope developers ignore this advice.

Fire up *GLQuake*, and the world of semitransparent water and reflective surfaces is yours.

The 2D chip onboard the Stingray is the Alliance ProMotion-AT3D, which delivers good 2D windows acceleration and support for high resolutions and color depths, but no native VESA 2.0 support (and UniVBE failed to fix it!). The video support is impressive, but scaled video looks pixelated. However, the accelerated video window falls apart entirely whenever other windows overlap it—video must be in the foreground window.

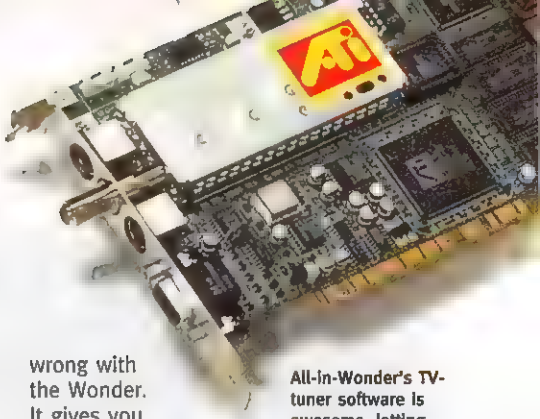
Right now, with better Direct3D support and more native titles, 3Dfx is king. If you're itching for a 3Dfx and don't have a slot to spare, the Stingray 128/3D won't let you down.

3Dfx's Voodoo Rush teams up with the Alliance ProMotion-AT3D for some polygon-pushing power.

Product ***Stingray 128/3D***
Price ***$299***
Company ***Hercules***
Phone ***800.532.0600***
URL ***www.hercules.com***
Bundle ***TBD***

ATI **All-in-Wonder**

Snazzy do-it-all



All-in-Wonder's TV-tuner software is awesome, letting you keep up on a dozen channels at once in tile mode.

boot KICK ASS! PRODUCT

Don't be fooled. This is not a new product. The ATI All-In-Wonder is merely the imminently bootWorthy 3D Xpression+ PC2TV merged with its video-capture/TV-tuner companion card in a single-slot package. Throw in some finely polished drivers, a good software bundle (*Director 4.0*, *PhotoSuite*, and *MechWarrior 2*), desktop TV-tuner capabilities, and a lot of good karma, and you have the makings of one awesome package.

ATI does miraculous things with the Wonder's 4MB of DRAM. There just shouldn't be enough memory bandwidth available for a card to run true color (24-bit) at 1280x1024, yet the All-In-Wonder does it and does it well. This high-res work had traditionally been the domain of more expensive VRAM and SGRAM architectures, but the Wonder is even able to do high-color (16-bit) at 1600x1200 and still deliver good 2D-speed while simultaneously supporting full-screen filtered and scaled video. Simply amazing.

On the 3D side, the Wonder is no 3Dfx, but it made it through all of our 3D benchmarks, holding its own with very playable frame rates in *Hellbender* and *Hyperblade*. More challenging titles bogged down significantly, but less so than on most other integrated 2D/3D chips (not including Vérité).

If you're short on free slots and want to do as much as you possibly can, you can't go wrong with the Wonder. It gives you excellent 2D, support for very high resolutions, the best video playback anywhere, great drivers, good video capture, rock-solid TV-out (at up to 800x600 res), excellent stereo TV-tuner software—even full-featured 3D acceleration. You may be able to get better components by shopping around, but this ATI board has no weak spots. Add this and a PowerVR or 3Dfx 3D-only card to your system, and there's nothing you can't handle. Just wonderful!

— Chris Dunphy

In addition to the VGA-out and antenna/cable-in, the All-In-Wonder provides an A/V-in and -out jack that breaks out into S-video and composite TV inputs and outputs for capturing video or watching your PC's output on the big screen.

Price *2MB $259; 4MB $285*
Developer *ATI*
Phone *905.882.2600*
URL *www.atitech.com*

boot verdict 9

Star Command Revolution

Who says cloning is bad?

Star Command Revolution has you trekking across the universe in your cool-looking mothership in search of valuable resources with which to strengthen your galactic control.

TRY IT ON THE DISC

In *Star Command Revolution* (yet another real-time strategy game) you can choose to fight (again) as one of four races (big surprise): Terrans, Triumverites, Computrons, and Nomads, all fighting for their survival in the galaxy (can't we just all get along?). Granted, this may not be the most original game, but it's still fun.

Begin your quest using your captured Ahkun Vek mothership to trek across the universe in search of resources to harvest. The mothership sends out a shuttle to collect the valuable crystals, radioactive asteroids, plasma, gaseous anomalies, and solinite, all of which are needed to advance the construction of your units. Universities, Academies, Programming, and Battle Schools play an important role in advancing and learning new technologies. Naturally, the mothership must be protected at all costs, providing ample opportunity to kill. And kill. And kill even more. Of course, destroying your opponent's mothership makes killing your foes all the easier (it's sorta like fishing... lure the enemy close to your fleet, then let the plasma fly).

Gameplay is pretty straightforward and simple, and with the intuitive "click and move interface" you'll be entering skirmishes without having to open the skimpy manual or read the online documentation. From the main screen alone, you can send messages, see your ship's ranking, select new technology, and launch new ships. It doesn't get much simpler than that.

The 640x480 SVGA art looks great, and thanks to the optimization of the 256-color palette, *Star Command* possesses some beautifully detailed backgrounds, with a cornucopia of cool looking ships and buildings (more than 64). The 2D sprites are all anti-aliased, and the graphics are very smooth and richly textured. The combat music is reminiscent of the *Battlestar Galactica* TV show, and sets the mood for battle scenes throughout the game.

While *Star Command Revolution* won't win any awards for originality, this clone is still worth playing.

— Tommy Maple

CHECKLIST

Maximum Resolution/Color
640x480/8-bit
Multiplayer
Internet and IPX/Network support for up to 4 players

Price *$50*
Developer *Metropolis Digital*
Publisher *GT Interactive*
Phone *800.305.3390*
URL *www.gtinteractive.com*

boot verdict 7

Links LS
1998 Edition

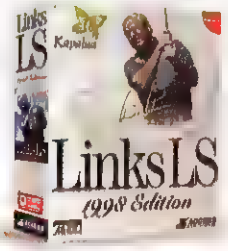
THE ART *and the* SCIENCE *of* GOLF

Introducing the Links LS 1998 Edition. The forces of art and science have combined to produce a golf experience like never before. This new version of the Codie Award winning golf simulation is packed with over 25 new features! Here's just a few:

Brace yourself for lightening-fast redraws, main view in a window capability, and up to 8 additional "smart" camera views.

Our course designers have given even more attention to detail including new water reflections, improved textures and enhanced sky backgrounds.

Notice the new waving flags, birds, airplanes and other background animations with up to 8 of your friends over expanded Internet play!



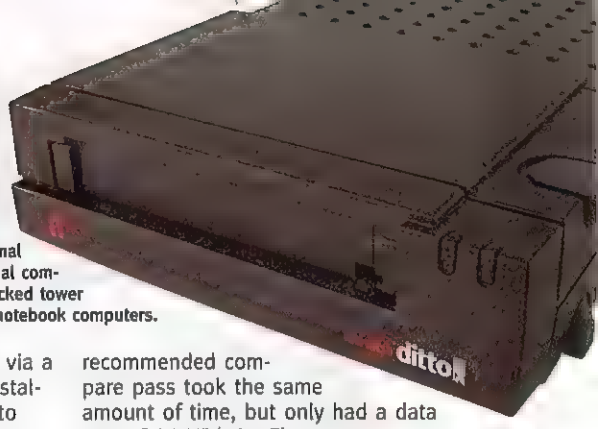
ACCESS SOFTWARE INCORPORATED

Phone Toll-Free 800.800.4880 • Fax 801.359.2968
Website–http://www.AccessSoftware.com
Available for the PC

Product Information Number 80

Iomega Ditto 2GB

A portable plum



With such a small footprint, the external Ditto 2GB is an ideal companion for fully packed tower cases or portable notebook computers.

After spending the better part of a day FTPing all the latest drivers and coolest programs from the net to your PC at work, how do you get all those files home? You could plug 3,000 floppy disks into the A:\ drive, or you could plug in a Ditto 2GB external tape drive and be done in this lifetime.

With a 9.5MB/min maximum transfer rate, 2GB of data backs up in about three hours—and you can do it unattended via a scheduler or as a background task. Installation consists of plugging the unit into your parallel port (yes, there is a pass-through connector for your printer), popping in the included CD-ROM and selecting which dialect you'd like to use. A power switch would be nice. As it is, the drive stays on as long as there's power supplied to the hefty wallwart (another annoyance).

Once Windows boots, you're prompted to back up your drive with a simple "one-step" backup or restore option. Click and go. For more discriminating tasks, the Ditto tools v5.2.1 package has all the options you'll ever require. We even restored a few data files from some very old QIC-80 tapes without a hitch.

The Ditto software estimated it would take four hours to back up 7,397 files taking up 432.9MB on one of our servers. But when all was said and done, it only took 1:08 hours with a Stac-High compression ratio of 1.5:1 and an average data transfer rate of 7.4MB/min. Performing a recommended compare pass took the same amount of time, but only had a data rate of 4.7MB/min. Eleven errors were found and repaired automatically (that's why the function's there).

You can position the Ditto horizontally or vertically, and it's easily portable, with dimensions of around 5x8x2 inches, a scant weight of 1 pound, 4 ounces, and the ability to withstand a shock of up to 50Gs.

The biggest irritant is that no tape is included! But for the price, and its ease of use, the Ditto 2GB does what it claims to. This is a great value.

— Daevid Vincent

Tape Compatibility

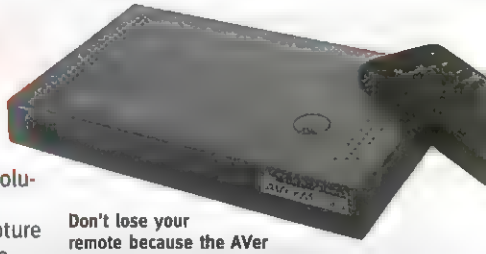
The drive will read all these formats, but it only writes to Ditto 2GB tapes.

Tape Format	Tape Type
Ditto 2GB	Ditto 2GB
QIC-3020 Travan	TR-3
QIC-3020 Wide	3020XLF
QIC-3020	3020XL
QIC-80 Travan	TR-1
QIC-80 Wide	5122
QIC-80XL	2120XL
QIC-80	2080 or 2120
Irwin 40 and 80	2000

Price *$199*
Company *Iomega*
Phone *888.246.6342*
URL *www.iomega.com/product/ditto*

AVer TVGenie and Proview

Make your PC monitor a boob tube



Don't lose your remote because the AVer TVGenie can't do much without it.

Sell your TV. And if you don't have one, don't buy one.

The AVer TVGenie and the Proview TV-Box are part of the new generation of NTSC converter boxes that make it possible to watch television and play console games on a high-resolution PC monitor.

Both boxes come with all the cables needed to get up and running. They even include a remote control. You only have to provide the input: an antenna or cable hookup or console gaming system. Because the boxes connect between your computer and your monitor, no drivers are needed.

But delve deeper, and minor flaws emerge. The TVGenie doesn't deliver magical picture quality. Reception is dark and hazy compared to the Proview, and both boxes display lines of distortion and interference on the top or left side of the picture. The biggest problem is video resolution inside Windows. Ghost images from the TV signal are visible when your video card is set to resolutions of 1024x768 or above, causing eyestrain when you're reading documents. If you plan to run high resolutions in Win95, consider investing in a TV tuner/capture card from ATI, STB, or Miro.

Once hooked up, these boxes need never be removed. Switching between TV and computer is done via the remote (only the Proview has buttons on the unit itself). Each has input and output VGA ports for the monitor and speakers, and both boxes allow you to listen to the TV while using the computer, but only the AVer TVGenie has S-video ports. Both boxes have auto-channel scanning capabilities, on-screen display, and a bevy of fine-tuning controls.

It's unbelievable how much better the picture quality of a computer monitor is compared to even the best television screen. You haven't really played a PlayStation game 'til you've played it on a 20-inch monitor with a dot pitch twice as fine and refresh rates twice as fast as the best TV.

— Sean Cleveland

The Proview TV-Box has everything except S-VHS hookups, which don't noticeably improve the resolution anyway.

Product *AVer TVGenie*
Price *$149*
Company *AVerMedia*
Phone *510.770.9899*
URL *www.aver.com*

Product *Proview TV-Box*
Price *$119*
Company *Proview Technology*
Phone *714.379.4455*

Interstate 76

A stone-cold groove

Wreak havoc with high-caliber artillery and check out some impressive explosion action. Don't worry folks, the stunt man got out just in time.

TRY IT ON THE DISC

Vehicular violence has never been funkier than *Interstate 76*'s hyperstylized mix of muscle cars and high-caliber artillery. It's *Mad Max* in bell bottoms on a raucous jaunt across an apocalyptic American Southwest, and pumping through the speakers in this bad-ass ride is an original soundtrack that's groovy as all get out.

Turn back the clock to an alternative reality, where the 70s are cooler than they ever actually were. A time before catalytic converters, when cars were cars and the air was dirty. At the height of the energy crisis an oil-starved world needs protection from the evil Antonio Malochio's plot to destroy the last of the oil reserves. Enter easy rider Groove Champion, inheriting the mantle of autovigilante from his murdered sister, and his mentor, the ex-poet Taurus.

Interstate 76 offers full support for multiplayer options and Activision's battle.net-inspired 176.net is a great place to meet and run down strangers.

At first glance, the graphics look like they're straight out of *MechWarrior 2*, but Activision rebuilt the engine for this romp. Say goodbye to the step-stool polygon landscape of *MechWarrior 2* and say hello to the smooth-rolling texture-mapped terrain of *I-76*. However, not all parts are newly refurbished. One ugly little detail that plagued *MW2* is the polygon warping that consistently crops up in the terrain. *I-76* has this warping bad—watch carefully when you're on the move in *I-76* as roughly rendered cliffs distort and change shape. And speaking of ugly little details, couldn't something be done about the color banding on the horizon where a gentle gradient transition should be? Direct3D, we need you!

Unfortunately, the Direct3D support that was supposed to ship with the game won't be ready until long after this review is finished.

Activision has paid particular attention to detail in *I-76*. Small rubber polygons fly from the tires when you slam on the emergency brake. Other notable special effects include the particle-generated smoke trails left by missiles, the explosions with identifiable pieces, and the realistic perspective shadowing effects. Also, listen and you'll notice distinctly different humming in the background as the tires come in contact with different terrain.

With cut scenes seamlessly integrated with the in-game engine, you'll be hard pressed to see where the scene ends and the game begins. The notable exception is Everett Mann's limp starring role as Groove. In the scenes where he isn't upstaged by his own walrus mustache, the scene's stolen by his co-star James W. Styles. Styles brings just the right amount of Samuel L. Jackson's *Pulp Fiction* fervor to the 'fro (comprised of 150, count 'em, polygons) that is Taurus.

But it's not acting that makes action games gut-wrenchingly spectacular. It's the feel-your-butt-tickle-as-your-wheels-leave-the-ground realistic physics models driving them. When Groove's car skids out, it really looses traction; when he rams head-on into an oncoming creeper, the entire screen jolts and shudders. The way cars handle off-road terrain in this game is realistically modeled. Blow out a tire and not only does the steering go wobbly and the fwop-fwop noise flaps to the side, but the external view will show the loss.

Be your own cinematographer in *Interstate 76* with 11 different views of the muscle car face-offs.

The numerous enemy cars are controlled with an AI advanced enough to make them challenging to defeat. Watch your opponents spew oil as you chase them—they're waiting for you to hit the oil slick and spin out so they can shoot the side of your car full of lead. All of this would be even more spectacular if cars wouldn't sometimes appear halfway in a hill.

By the time you read this review, Activision will hopefully have released the patch that takes this game beyond the ugly world of flat-shaded polys—but until then, don't let this stop you from enjoying the intense *Car Wars*-inspired violence of *Interstate 76*.

— Sean Downey

Slap in an 8 Track and prepare for a groove more pimp than the Superfly.

CHECKLIST

Maximum Resolution/Color
1024x768/16-bit
Win95 Native
DirectX
DirectDraw DirectSound
DirectPlay DirectInput
Multiplayer
LAN Modem Internet

Price *$50*
Developer *Activision*
Publisher *Activision*
Phone *310.473.9200*
URL *www.activision.com*

boot verdict 8

Wannabe ViRGE Killers

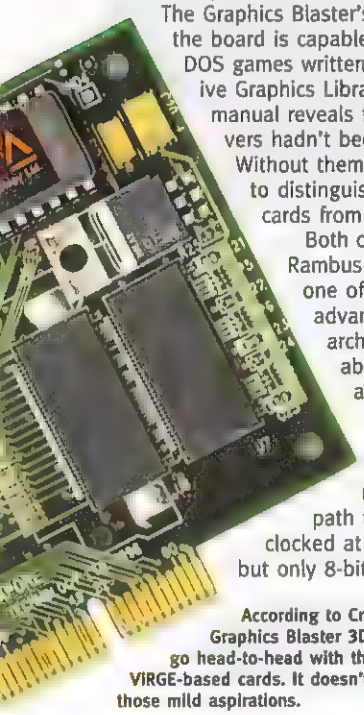
The GrafixStar 550 and Graphics Blaster 3D are like a bad acid trip

Last fall, *boot* summarized the Laguna 3D chipset as "better late than never." Little did we know that the first Laguna-powered boards would miss the planned holiday season rollout, finally arriving on store shelves in April. Unfortunately, the $99 price tag is the only impressive thing about this 4MB card.

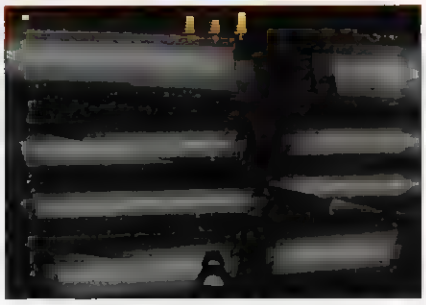
There is little difference between these two Laguna-based cards. The Graphics Blaster 3D has a more polished display utility and slightly faster Win95 performance, while the GrafixStar 550 is more stable and glitches 2D less (and had the honesty to leave "3D" out of its name).

The Graphics Blaster's box claims that the board is capable of accelerating DOS games written for CGL (Creative Graphics Library), but the manual reveals that those drivers hadn't been finished yet. Without them, there's nothing to distinguish one of these cards from the other.

Both cards use speedy Rambus RDRAM memory, one of the most advanced memory architectures available. Rambus achieves amazing memory bandwidth by going fast and narrow—the data path to memory is clocked at over 600MHz, but only 8-bits wide. This gives a memory access speed of 667MB/sec, and keeps board design simple because there's no need to route a wide 128-bit path to RAM.



According to Creative Labs, the Graphics Blaster 3D was designed to go head-to-head with the Mystique and ViRGE-based cards. It doesn't even live up to those mild aspirations.

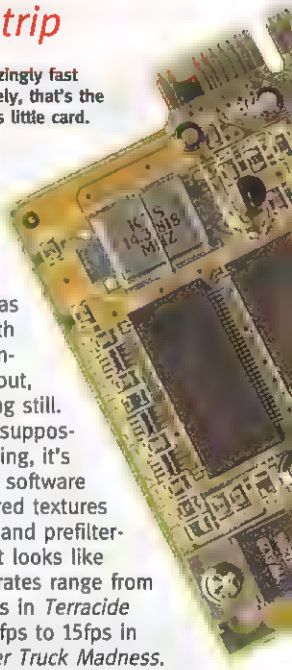


This in-your-face shot of a wall from *Terracide* shows off some of the horrible visual artifacts the Laguna 3D generates.

The fast memory access, coupled with a 230MHz RAMDAC should support high resolutions and color depths, but both boards are unwilling to do 1600x1200, even though they're supposed to deliver 8-bit color at 60Hz in that resolution. The best we could get out of either was 16-bit color at 1280x1024 and 24-bit color at 1024x768. Fairly mundane stuff. At least Windows performance, while it didn't set any speed records, kept pace with other recent cards.

Gaming performance, however, is abysmal. *Quake* cranks only 8fps at 640x480—half the speed we've come to expect. At least VESA 2.0 drivers are built into the BIOS, solving that headache. Under Windows, DirectX games fair little better. On both cards our *MDK* performance test scored only a 79, a far cry from the 96 seen on comparable graphics cards tested this issue in the same P200 MMX benchmarking machine.

The Laguna provides no native-mode 3D API, instead claiming to be optimized from the ground up for Direct3D. Direct3D performance is perky, if you can stand to look at it for long. Every game we tried was like a bad acid trip, with disjointed textures shimmering and moving about, even when you're sitting still.



The GrafixStar 550 uses blazingly fast RDRAM memory. Unfortunately, that's the only thing blazing about this little card.

Though the Laguna supposedly does bilinear filtering, it's actually emulating it in software by upsampling the stored textures to a higher resolution, and prefiltering. Sounds nice, but it looks like unfiltered crap. Frame rates range from a decent 20fps to 30fps in *Terracide* to a barely playable 10fps to 15fps in *Hellbender* and *Monster Truck Madness*. No matter what we played, the screwy visuals hurt our eyes and distracted us from the game.

The one highlight is the hardware's great video acceleration. Scaled video is just short of ATI's quality, with minor pixelation and only slight loss of sharp edges.

The price may be tempting, but something is amiss with these boards. The Laguna architecture appears to have potential and will likely be among the first AGP graphics chips. Maybe then it'll be worth another look.

— *Chris Dunphy*

Head-to-Head Workstation

	GrafixStar 550	Graphics Blaster 3D
Max 24-bit Resolution/Refresh	1024x768x85Hz	1024x768x85Hz
Max 16-bit Resolution/Refresh	1280x1024x85Hz	1280x1024x85Hz
VESA 2.0 Support	Yes	Yes
Virtual Desktop Support	No	No
MDK PerfTest	79	79
WinMark 97 10x7x16	57.1 / 20.9	61.9 / 23.3
Quake 640x480	8.1fps	8.1fps
Quake 800x600	5.2fps	5.2fps
Terramarks (L1, L2, L3)	208, 174, fail	210, 174, fail

Ziff-Davis Business Graphics WinMarks / High-end Graphics WinMarks

Product GrafixStar 550
Price $99
Company VideoLogic
Phone 415.875.0606
URL www.videologic.com
Bundle ProLab Multimedia Software

boot verdict 3

Product Graphics Blaster 3D
Price $99
Company Creative Labs
Phone 800.998.5227
URL www.creativelabs.com
Bundle MS Interactice CD Sampler, VREAM WIRL VRML Browser

boot verdict 3

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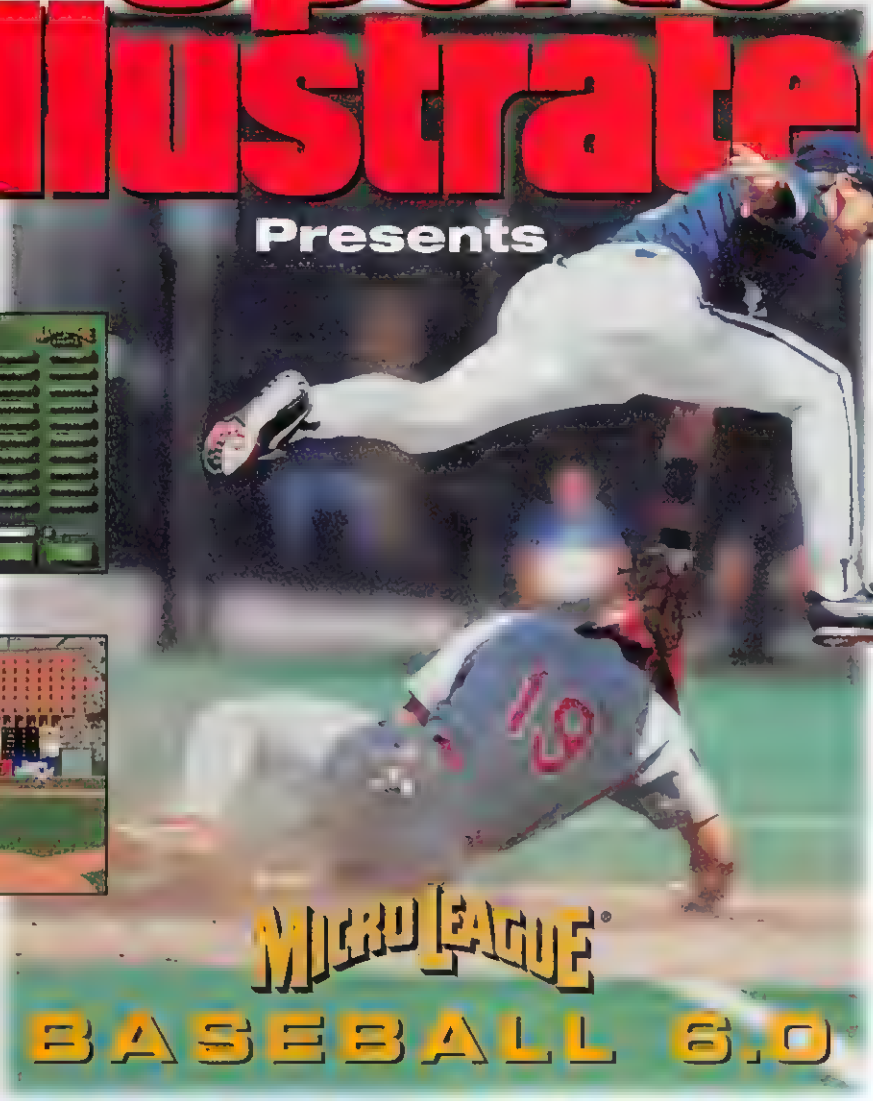

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Product Information Number 239

Xi MX200

The ultimate love/hate relationship

Buying the Xi MX200 is like marrying Cindy Crawford and finding out she has halitosis, nasty bunions, and a bad case of flatulence.

The MX200 looks darn right romantic, with Tyan supplying their S1572 430TX-based ATX backbone. The motherboard harbors four full-length, bus-mastered PCI slots, two ISA slots, and the obligatory shared PCI/ISA slot. Things look even better when you take a gander at the spacious interior, with two free 3.5-inch and three 5.25-inch drive bays. A single 32MB DIMM handles the RAM requirements, with an additional six SIMM and another DIMM slot ready to be filled. With Intel's P200 MMX, 512K of soldered-on L2 cache, and oodles of storage thanks to Maxtor's 85120A DiamondMax 4.9GB EIDE, what could possibly spoil the magic?

Plenty.

Start with the pathetic Addonics Sound Vision 510 sound card. Based on Yamaha's moldy oldie OPL-3SA FM synth chip, it plays digital audio fine through Win95 and a DOS shell, but if your DOS game doesn't directly support the card, you're ass out and digital soundless. This ultra-flaccid software-based Wave-Synth will have you crying in your pillow. The fact that the MX200 defaults to the FM-synth for MIDI playback is also heart-wrenching. It's a pity those Kick-Ass Altec Lansing ACS-45 speakers are tormented by this timbral travesty.

Then you notice STB's Velocity 3D with its whopping 8MB of dual-ported EDO-VRAM. It's great for Win95 2D performance, but where the hell is VESA 2.0 support? You'll be asking the same question when you fire up SVGA *Quake* without *Display Doctor* handy. Why Xi decided against installing the feature-rich Velocity 3D drivers boggles the mind.

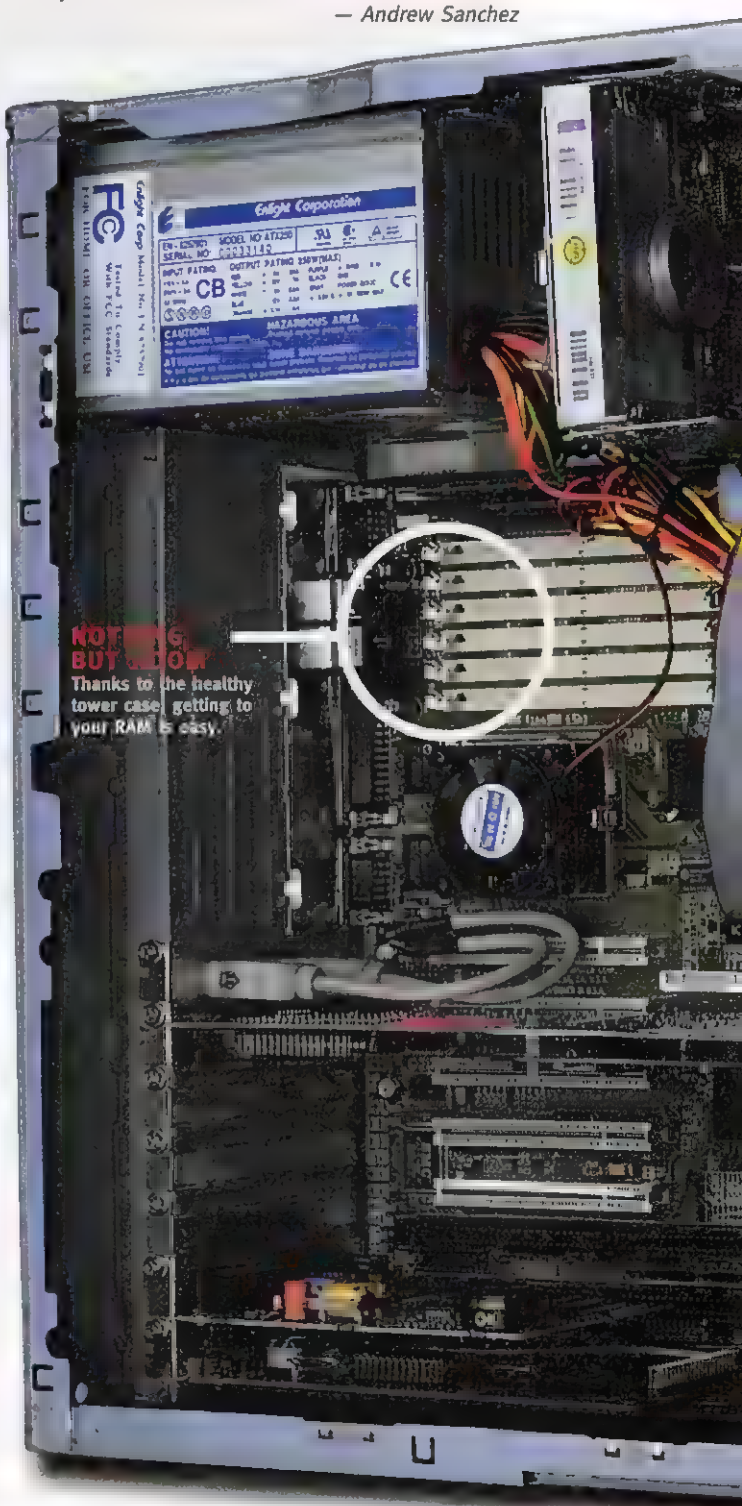
As you wonder about Xi's choices, the pangs of missing real-mode CD-ROM drivers and an improper digital sound card haunt your daunting DOS sessions. And while it's nice to have twin USB ports, it's not worth the PCI slot being rendered impotent.

What really throws you in a cold shower is the system's performance.

Despite an outstanding bootMark of 57.0, excellent overall Win95 application scores, solid hard-drive performance, and killer DirectX gaming results, the Xi MX200 got medieval on our bruised egos and failed to run the Direct3D test, like every other S3 ViRGE-based "solution" we've encountered. Without a sexy polygon pusher, *Hellbender* and *Hyperblade* never reach their slippery-smooth frame-rate potential.

What starts out as a possible match made in heaven—with killer pricing, excellent subsystem performance, and whispers of quality parts—becomes a heartache filled with tired 3D, soul-wrenching sound cards, and ultimately, a relationship that fails to fulfill your innermost needs.

— Andrew Sanchez

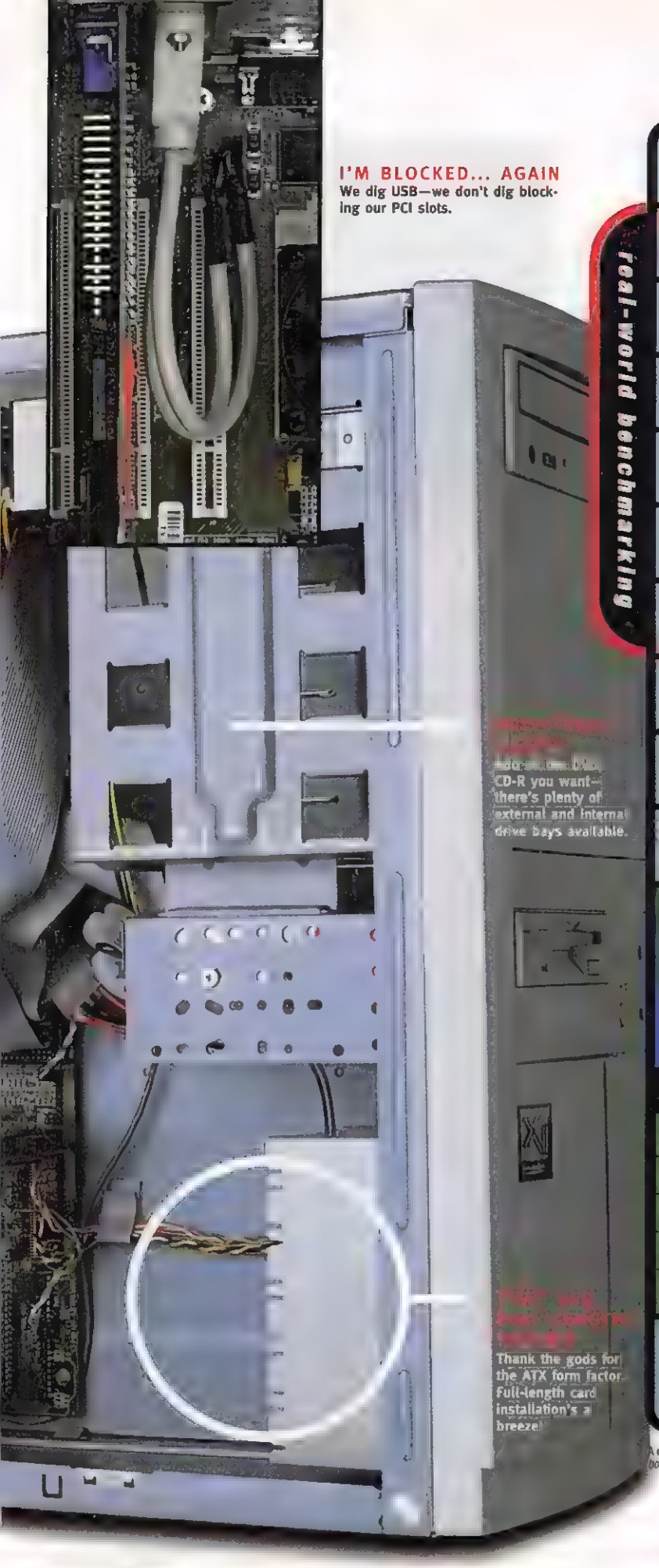


under the hood

THE BRAINS	
CPU	Intel Pentium 200 MMX (P55C)
L2 Cache	512K (external pipeline burst)
RAM	32MB DIMM (128MB max)
Motherboard	Tyan S1572 ATX
THE BRAWN	
Video	STB Velocity 3D (S3 ViRGE) with 8MB EDO-VRAM
Hard Drive	Maxtor 85120A DiamondMax 4 9GB EIDE
CD-ROM	Hitachi CDR-8013 16x CD-ROM drive
Expansion Bus	Four PCI slots; two ISA; one PCI/ISA shared
Fax/Modem	US Robotics Sportster 5600 fax/modem
I/O Ports	Two USB ports; two serial ports; one parallel port
THE BEAUTY	
Display	ViewSonic Optiquest V773 0.26dpi, 1280x1024 @ 24-bit color/60Hz
Sound	Addonics Sound Vision 510 FM synth sound card (Yamaha OPL-3A chipset)
Speakers	Altec Lansing ACS-45 3-way subwoofer/satellite system

THE BUNDLE Windows 95

boot :46 down :2



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CD-R you want—there's plenty of external and internal drive bays available.

Thank the gods for the ATX form factor. Full-length card installation's a breeze!

real-world benchmarking

XI MX200

CPU/MOTHERBOARD	bootMark	57
WIN95 APPS	SYSmark32	194
DIRECT 3D	Terramark	no 3D card
HARD DRIVE	Adaptec ThreadMark v1.0	MB/sec 3.34
CD-ROM	CD Tach/Pro v1.65	K/sec 1820
WIN95 VIDEO	VidTach v1.52	% played 30.2
DOS GAMING	Quake v1.06	fps 16
DIRECTX GAMING	MDK PerfTest v1.4	81
MMX PROCESSING	DeBabelizer Pro	secs 365
CPU/DISK	Microsoft Visual C++ compile	secs 168

The XI MX200 wants to strut its stuff, but leaves us limp with its mishmash of components.

+

- P200 w/MMX
- Motherboard armed with 430TX PCIset
- The best sub-$100 speakers you can get
- Excellent subsystem performance
- Mounting rails for adding 5.25-inch drives

−

- [illegible] Blaster AWE
- horrid sound
- standard [illegible]
- DOS mode drivers not
- [illegible] used correctly
- extra IDE cons
- VESA 2.0 support
- 128 Velocity 3D Video
- [illegible] not

Price $2,549
Company XI Computer Corp.
Phone 800.432.0486
URL www.xicomputer.com

boot verdict 6

A complete breakdown of benchmark results is available on the bootNet. Point your browser to www.bootnet.com

Ecstatica 2

A 3D adventure with a different shape

Wielding weapons such as a sword or staff will help you fend off *Ecstatica 2*'s menagerie of well-rounded ellipsoid creatures.

TRY IT ON THE DISC

Sure, it has clever 3D technology and an absolutely unique visual style. But more importantly, *Ecstatica 2* has a near-perfect balance of action and adventure that's just plain fun.

The premise is familiar: You must recover the seven pieces of the Elder Seal, hidden within a sprawling medieval castle and guarded by hordes of shambling creatures and their sorcerous masters. Play is in real time with randomly respawning creatures providing lots of action between locked-door puzzles.

The view is third-person, with both your on-screen hero and his adversaries displayed as assemblages of football-shaped "ellipsoids" rather than the usual slab-sided polyhedrons. This gives the game a nifty organic look—and very zippy performance.

At the default resolution of 640x480 in 256 colors, display is almost unnaturally slick, with hardly any discernible pixelation. Despite the lack of support for 3D hardware accelerators, frame rates remain fluid even on trailing-edge Pentiums. The publisher promised a 320x200 option in the shipping version, but it hardly seems necessary.

The major trade off is that the 3D world is partitioned into a series of pre-rendered rooms or areas, each based on a single fixed camera viewpoint. To keep things from appearing too static, these viewpoints vary dramatically from room to room. So, in the Main Hall you see your hero from shoulder height, while out in the courtyard you get a bird's-eye view.

This scheme suits the adventure-oriented play of *Ecstatica 2* surprisingly well. The downside is a tendency for the game to hesitate when new room art is loaded, even on a P166 with a 6x CD-ROM drive. The momentary lag is enough to get you badly mauled or let you walk off a cliff.

Keyboard control is the only option, but works effectively. You move using the arrow keys. Add the Ctrl key for various weapon attacks, both Ctrl and Alt for magic attacks, or Alt alone for rolls and other special moves.

Combat is lively thanks to a wide variety of creatures and weaponry, but not terribly taxing. Even the final boss, the Archmage, is readily dispatched.

Similarly, the adventure component is light and painless, a matter of matching key items with lock items. But there are twists—such as a complex, time-limited maze in the endgame.

The architecturally complete castle setting is one of the game's strongest assets. It has a lived-in feel that makes you want to keep exploring and never gives you that rat-in-a-maze feeling (which is just as well, since to solve the quest you'll traverse just about every nook and cranny, from the tunnels at the bottom of the well to the dizzying spiral steps of the highest turret).

With its finite, single-player quest, *Ecstatica 2* doesn't offer much replay value, but its quirky good humor and lavish imagery make it a vastly entertaining one-time excursion.

— Frank Lenk

Well-chosen camera angles show off ellipsoid-rendered characters to full advantage.

Explore the sprawling medieval castle in *Ecstatica 2* and battle a bevy of hoary beasts in real time.

CHECKLIST

Maximum Resolution/Color
640x480/8-bit
MS-DOS
Win95 Native
DirectX
DirectDraw DirectSound

Price *$60*
Developer *Andrew Spencer Studios Ltd.*
Publisher *Psygnosis*
Phone *800.438.7794*
URL *www.psygnosis.com*

boot verdict 8

Ellipsoid Technology

UK-based developer Andrew Spencer created the *Ecstatica* ellipsoid rendering engine several years ago as a way of animating rounded objects without breaking them into numerous discrete polygons.

Each hand-animated character in *Ecstatica 2* is built using 40 to 80 ellipsoids. Even the walls are built of ellipsoids, although a few polygons do creep in for elements such as angular sword blades and the odd wall hanging.

The only problem with ellipsoids is that they can't be accelerated on standard polygon-based 3D hardware. However, Spencer hopes Intel's MMX technology will work with ellipsoids for his next game project.

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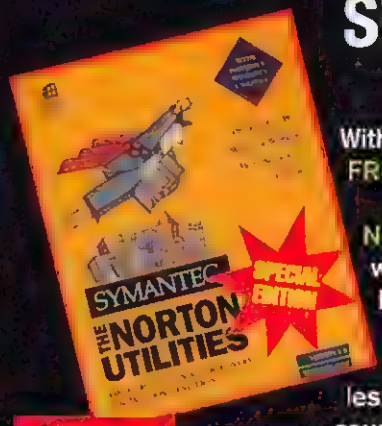

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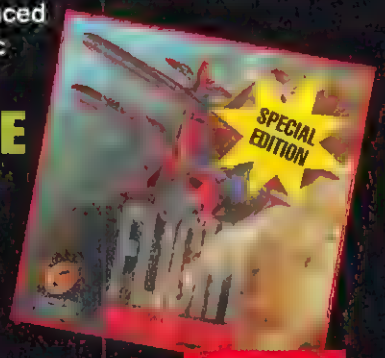

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boot

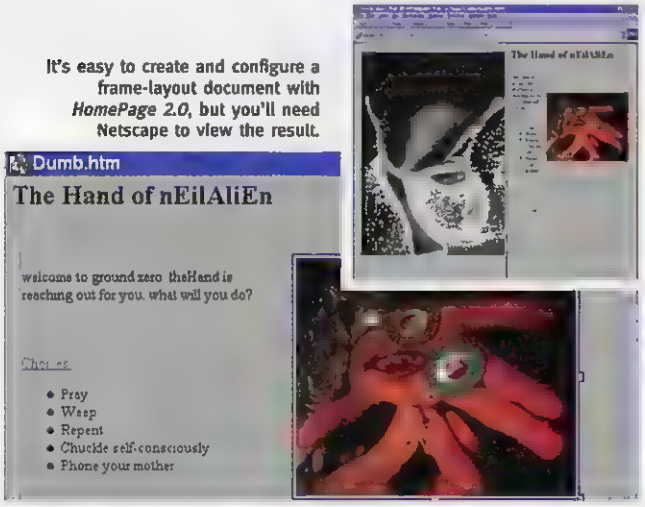
HomePage 2.0

Casually ambitious

HomePage 2.0 is the tool you want if you'd rather do drag-and-drop, WYSIWYG page layout than geek out over HTML tag syntax, and you'd rather fork over less cash than get full site management. It lets you do pretty much everything without a mess of detail in your face, and still makes it reasonably easy to get at that detail when you want to.

Take adding images, for example. Any file that's not a GIF or JPEG is auto-converted to GIF format on insertion, and handles attached to the image move or resize the image exactly as you can in *Word*. Right-clicking gives you access to editors for image mapping, transparency, interlacing, and the underlying HTML. The same goes for tables and frames; just click and drag boundaries to get what you want, quicker and easier than any tool we've seen.

On the downside, it's impossible to select and operate on multiple cells without selecting the entire table, and alignment of cell contents must be done on a per-cell basis. We also noticed discrepancies between *HomePage*'s previewing of tables and *Navigator 3.0*'s rendering, but no HTML editor seems to render everything exactly as it will appear in mainstream browsers.



It's easy to create and configure a frame-layout document with *HomePage 2.0*, but you'll need Netscape to view the result.

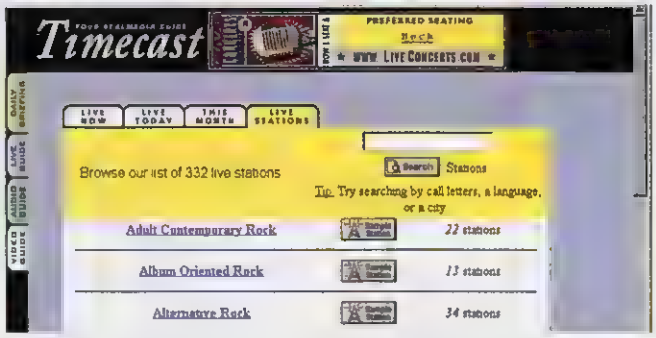
Drag an image from one table cell and drop it into another, then resize it simply by pulling one of the attached handles.

Dragging and dropping a QuickTime movie anywhere in an HTML document and immediately previewing it in *Navigator* is very cool, and it's almost as easy to do the same with a Java applet in *HomePage 2.0*.

HomePage doesn't give you detailed control of HTML code generation and presentation, and, inexcusably, multilevel undo is missing. The program also hung more than once. There's very little to the printed docs, and the online documentation has a nonstandard interface and is strangely slow. Nevertheless, the unique features of *HomePage 2.0* should compensate for its few idiosyncrasies.

— *Neil Redding*

Price $100
Developer Claris Corp.
Publisher Claris Corp.
Phone 800.544.8554
URL www.claris.com



***RealAudio*'s Timecast keeps you up-to-date on programs and live events.**

RealAudio Player Plus 3.0

Hear, hear!

Progressive Networks was one of the first companies to bring sound to the Internet, and now they're making good things better with *RealAudio Player Plus 3.0*. With the addition of a feature called PerfectPlay, even unfortunates using 14.4 modems can listen to high-quality audio online.

Unfortunately, that's all you'll be doing. *RealAudio* delivers ear-popping CD-quality sound through a 28.8K stereo stream—but it puts a hammerlock on your modem's bandwidth. Even with a 56K modem, you have to just sit back and listen, because even surfing to a web page will cause sound loss and rebuffering of the audio stream.

Not all Internet sites broadcast *RealAudio* with a 28.8K stereo data stream. Many use a 14.4K mono audio stream, which sounds like AM-quality radio. However, the 14.4K mono stream uses so little of your modem's bandwidth that you can web surf with NPR playing in the background.

If you find a clip you want to keep, you'll enjoy *RealAudio Player*'s new Record feature, which allows you to record clips from those data streams that allow recording.

RealAudio Player's control panel is friendly and easy to use, as is its online programming guide, Timecast. The only head-scratcher is *RealAudio*'s penchant for reporting connection problems with error numbers instead of plain-text explanations. (Hit the *RealAudio* web site for explanations.)

Endless sites offer *RealAudio* content. If you like listening to, as well as looking at, your web experience, go get it.

— *Tara Calishain*

Price $30
Developer Progressive Networks Inc.
Publisher Progressive Networks Inc.
Phone 206.674.2700
URL www.realaudio.com

Barring a revolution in compression technology or a cable modem in every pot, streaming video remains an interesting but impractical idea—even in a program as artfully designed as *RealPlayer Plus 4.0*, which blends streaming audio and video in a nicely designed control panel.

Audio quality is up to the *RealAudio* standard, but the video isn't there yet. On a 56.6K modem, video quality is jerky and impossible to follow. Streaming video looks more like a slide show. The video component of *RealPlayer Plus 4.0* has a lot of growing to do.

Air Warrior II

In the eye of the beholder

TRY IT ON THE DISC

It ain't much to look at, but beauty is only skin deep.

A reworking of the classic online World War II flight simulator, *Air Warrior II* was developed by Kesmai Studios, veterans of online games such as the original *Air Warrior* and *Multiplayer BattleTech*. But even by yesterday's standards, *Air Warrior* wasn't much to look at, despite its cult following.

The good news is that you can now fly *AWII* solo until you get the hang of flying. The bad news is that the game is still pretty darn ugly.

Of course, there's an upside: Even at 1024x768 (640x480 and 800x600 are also supported), the game flies silky smooth on a 200MHz Pentium with MMX, and there's no noticeable drop in quality on a P133. And, as any *Air Warrior* fan will tell you, frame rate is critical in a dogfight. The cockpit view can be set to three modes, and you'll learn that it isn't best to go full screen—you lose the cockpit chatter text in the intermediate screen mode. There's no voice chat and no 3D acceleration, just flat-shaded polygons—in fact, the newest technology in *AWII* is force-feedback joysticks.

In defense of *AWII*, jet sims rarely throw you into the middle of a furball. Most of their combat occurs beyond visual range with missiles. In WWI/II combat, every melee was a knife fight, and *AWII* can run up to 40 simultaneous planes in a mission. Other sims throw a handful of bogies at you at any given point. *AWII* has more than 300 missions and 35 planes, each with painstakingly accurate cockpit interiors. And unlike the original, *AWII* covers from World War I to the Korean War.

AWII also includes 20 hours of free play on CompuServe (the only place you can play *AWII* for now, though play on EarthLink and AOL is planned) along with a month's free access. While play can be laggy at times, *Air Warrior II* online is what it's about. That is, if you can stay alive long enough to enjoy it—and if you don't mind the drab view.

— Bernard Yee

Air Warrior II has lavish detail in its cockpits, which are modeled on those in actual fighter planes.

Detail may be abundant in the cockpit, but a drab—albeit deadly—world of flat-shaded polys is outside.

CHECKLIST

Maximum Resolution/Color
1024x768/16-bit

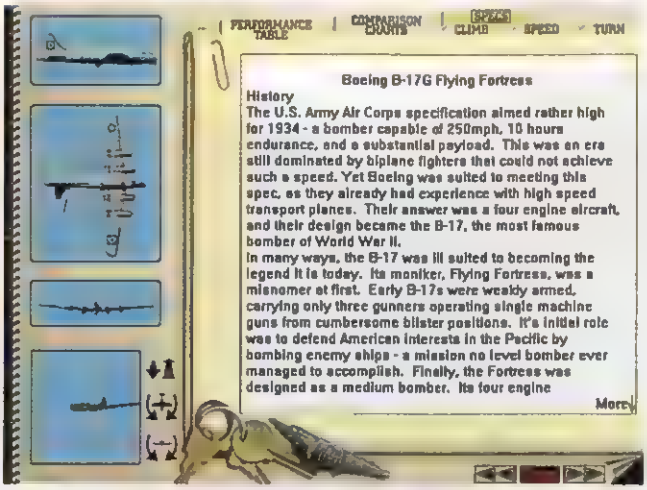
Win95 Native

DirectX
DirectDraw DirectPlay
DirectInput

Multiplayer
Modem Direct/serial
Internet (CompuServe, Delphi, EarthLink, Direct Web connection at Kesmai TBA mid-April—check www.kesmai.com)

Specialty Controllers
Force feedback Gravis Grip

The gang's all here: WWI, Pacific and European Theaters of WWII, and Korea.


PERFORMANCE TABLE
COMPARISON CHARTS
SPEED CLIMB
SPEED
TURN
Boeing B-17G Flying Fortress
History
The U.S. Army Air Corps specification aimed rather high for 1934 - a bomber capable of 250mph, 10 hours endurance, and a substantial payload. This was an era still dominated by biplane fighters that could not achieve such a speed. Yet Boeing was suited to meeting this spec, as they already had experience with high speed transport planes. Their answer was a four engine aircraft, and their design became the B-17, the most famous bomber of World War II.
In many ways, the B-17 was ill suited to becoming the legend it is today. Its moniker, Flying Fortress, was a misnomer at first. Early B-17s were weakly armed, carrying only three gunners operating single machine guns from cumbersome blister positions. It's initial role was to defend American interests in the Pacific by bombing enemy ships - a mission no level bomber ever managed to accomplish. Finally, the Fortress was designed as a medium bomber. Its four engine
More

Kesmai Studios is populated with a bunch of fighter-plane geeks, which is good news for hardcore fans looking for detail, detail, and more detail.

Price $55
Developer Kesmai Studios
Publisher I-Magic Games
Phone 800.789.1534
URL www.imagicgames.com

boot verdict 8

[illegible]

If all you want to do is fly solo (against computer AI, specifically) don't bother with *Air Warrior II*. Playing it online is the heart of what this game's about. No question, playing online is a more rewarding experience, with the camaraderie and competition that make multiplayer gaming so addictive. But there are a few warnings, the most important of which is: human players are skilled—especially the *Air Warrior* variety. Practice, practice, and practice some more if you want to get the most out of a real, live air battle.

At press time, there are only a few places you can play *Air Warrior II*. The game comes with a free-hours offer on CompuServe. The good news is that this lets you test your online prowess without racking up too many hours. The bad news is that you'll have to use CompuServe's bloated and sad 3.0 interface, with its 32-bit Winsock. Our attempts at using the simpler, faster WinCIM 2.5 didn't work. If you're lucky, check out **www.ariesgames.com** for the free open beta for *Air Warrior II* before it replaces the old *Air Warrior* for Windows on services such as America Online.

Micron TransPort XPE

Almost perfect

For years, hardcore PC techno-freaks have generally viewed notebooks with some disdain and a certain amount of arrogance. "A lowly notebook couldn't possibly compete with the all-powerful desktop computer," was the cry. But the performance of the new breed of notebooks nips at the heels of their desktop brethren. And with its 166MHz Pentium processor, MMX technology, and zippy overall performance, Micron's TransPort XPE is the perfect example of why notebooks can no longer be denied their due respect.

PORTS OF CALL
The rear of the notebook is adorned with a plethora of ports including the requisite PS/2, serial, parallel, and CRT ports, all of which are hiding behind an elaborate system of sliding panels.

The MMX moniker, guarantees some performance increase, but overall the TransPort XPE delivers rocking performance—especially in Win95. It consistently spiked the green (representing above average performance) in all but two of our extensive new benchmark tests: The CD-ROM transfer rates, while respectable, were only equivalent to a 7.7x. Given that our evaluation criteria is rather ambitious (we expect a lot from hardware!), the results have us stoked. The transfer speeds of the hard drive (more than 3MB/sec), DirectX gaming (which was almost on par with a 200MHz MMX desktop machine), and the punchy subsystem integration left an indelible impression.

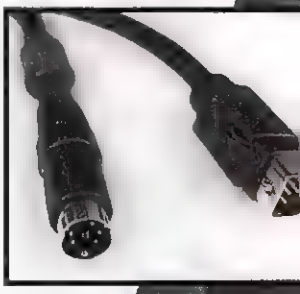
The 12.1-inch active-matrix screen's excellent off-axis viewing would be pure perfection with an analog brightness control (who in their right mind wouldn't want sliders for both brightness and audio volume?). MPEG playback in a maximized window is good—screen redraw is fast, but there's still noticeable pixelation around the edges of images. One major quirk for rabid *Quake* fans: The integrated Cirrus Logic CL-7555 graphics chipset doesn't support resolutions higher than 360x480, even with SciTech's *Display Doctor*. At press time, Micron still hadn't resolved the issue.

As for audio, we're stuck using the industry standard FM-synthesis crap until mobile wavetable sound solutions become available later this year. (If a wavetable solution isn't mandatory by then, we'll spew chunks.)

At first glance, the price of the TransPort XPE may seem steep. But factor in the excellent port replicator bundled with the notebook, and suddenly the $5,000+ tag seems more than fair. (Hell, the NEC Versa 6050MX reviewed in *boot* 09 costs more and doesn't include one.)

Quibbles aside, the TransPort XPE rocks. Once Micron fixes the video problem and upgrades the sound this notebook is a candidate for replacing your desktop machine. As it stands, it's still killer.

— *Bryan Del Rizzo*



under the hood

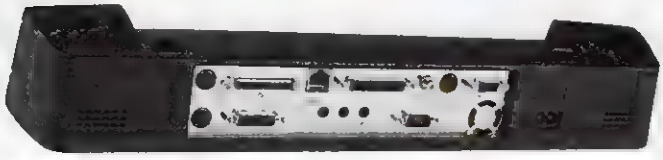
THE BRAINS	
CPU	166MHz Intel Pentium with MMX
L2 Cache	256K
RAM	32MB EDO (80MB max)
Video	Cirrus Logic CL-7555 (2MB VRAM)
THE BRAWN	
Hard Drive	IBM 2.1GB
CD-ROM	Sanyo 8x
Expansion Bus	Two Type II or one Type III PCMCIA card, Zoomed Video and CardBus compatible
Lap Weight	7 pounds, 6 ounces
Carrying Weight	8 pounds, 13 ounces
THE BEAUTY	
Display	12.1-inch active matrix
Sound	Creative Labs Vibra 16; QSound
Video	800x600, 16-bit color (1024X768 virtual desktop)
Speakers	Stereo speakers
Communication	33.6Kbps Motorola PCMCIA modem; dual IrDA ports

THE BUNDLE Win 95 ▮ Office 97 ▮ Quicken ExpensAble ▮ LapLink for Win95 ▮ Focal Point Communication Software ▮ Greg Norman Ultimate Challenge Golf

boot :10 down :2

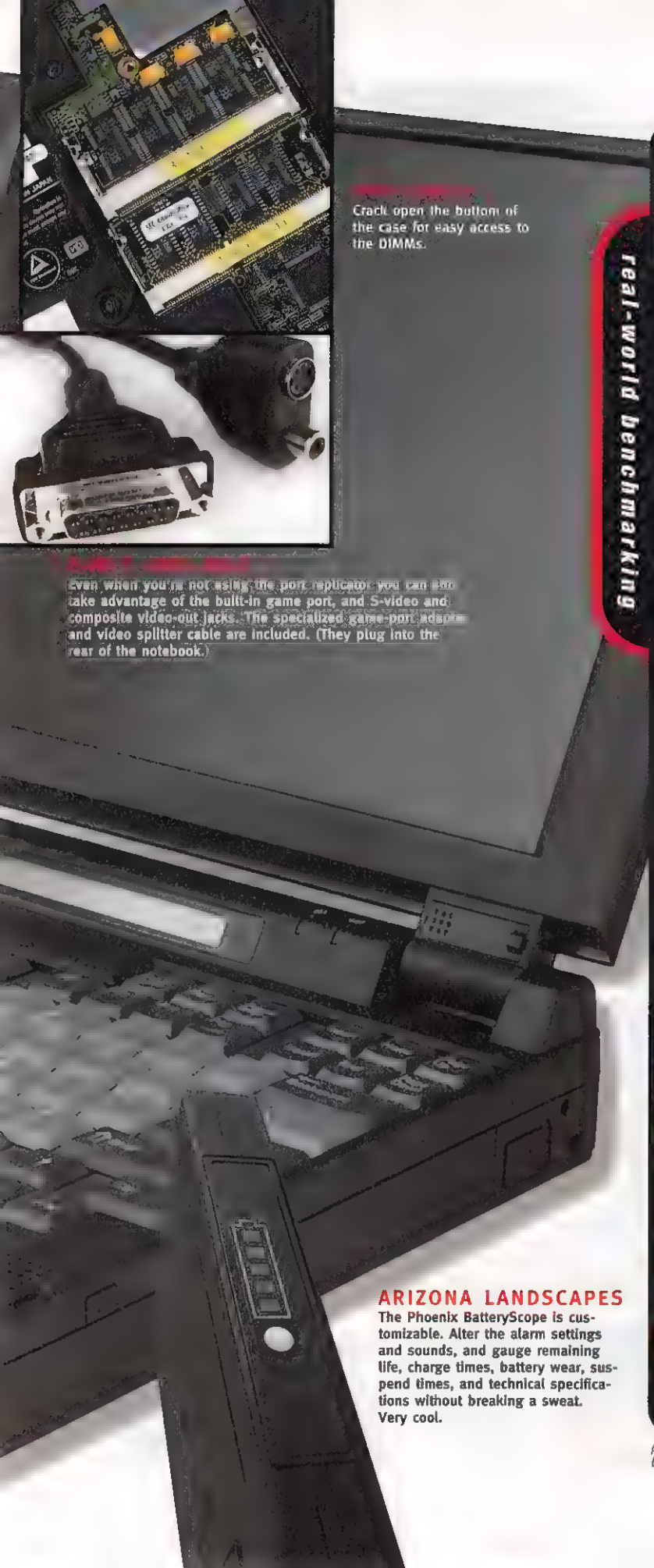
SOME GOOD, SOME CRAMPED KEYBOARD
While the ham-handed may not agree, the Chicklet-sized keyboard feels great, with just the right amount of play. Although there are two pointing devices—the blue stick and touchpad—only one works at a time. The notebook's three-watt speakers are positioned at the bottom corners (and will be covered by your hands and wrists while typing or keyboard-controlling games). Notice the absence of a Windows key.

YOU WILL BE REPLICATED
The port replicator goes one step further, including two separate video-out jacks, a built-in LAN, and speakers for easy network hook-ups.



Crack open the bottom of the case for easy access to the DIMMs.

Even when you're not using the port replicator you can still take advantage of the built-in game port, and S-video and composite video-out jacks. The specialized game-port adapter and video splitter cable are included. (They plug into the rear of the notebook.)



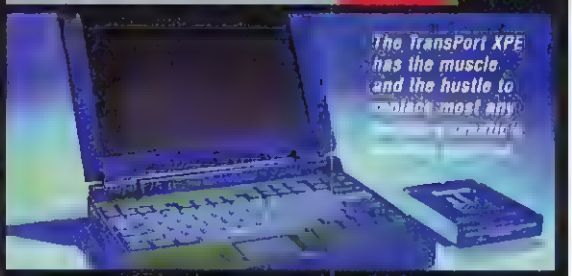
ARIZONA LANDSCAPES

The Phoenix BatteryScope is customizable. Alter the alarm settings and sounds, and gauge remaining life, charge times, battery wear, suspend times, and technical specifications without breaking a sweat. Very cool.

real-world benchmarking

Micron TransPort XPE

CPU/MOTHERBOARD	*bootMark*	46
WIN95 APPS	*SYSmark32*	152
DIRECT 3D		no 3D card
HARD DRIVE	*Adaptec ThroadMark v1.0*	MB/sec 3.06
CD-ROM	*CD Tach/Pro v1.65*	K/sec 1051
WIN95 VIDEO	*VidTach v1.52*	% played 32
DOS GAMING	*Quake v1.06*	fps 0 failed to run
DIRECTX GAMING	*MDK PerfTest v1.4*	81
MMX PROCESSING	*DeBabelizer Pro*	secs 441
CPU/DISK	*Microsoft Visual C++ compile*	secs 218



+

- [illegible] MMX processor with built-in power
- [illegible]
- [illegible]
- Excellent port [illegible]
- S-video and [illegible]

−

- VESA 2.0 incompatibilities
- FM-synth sound
- Floppy and CD-ROM drive swapping

Price $5,025
Company Micron
Phone 888.634.8799
URL www.micron.com

boot verdict **9**

A complete breakdown of benchmark results is available on the *bootNet*. Point your browser to www.bootnet.com

Fallen **Haven**

A gentler, kinder XCOM wannabe

Fallen Haven offers more than 15 territories to conquer in each scenario. So, position your tank forces to take out the laser towers, and start conquering.

TRY IT ON THE DISC

This turn-based strategy game clearly follows on the success of *XCOM* (and its wide audience appeal), but falls short of delivering a game that's a worthy successor.

Fallen Haven's premise is standard build/conquer/destroy fare. You're pitted against two belligerent alien races who want your colony, and hostile humans whose neutral territories you'd like to control. There are more than 15 territories to conquer in each scenario.

Like most games of this nature, when your colony is in place you spend money researching new technologies; managing resources, energy, and credits; and advancing your military prowess to survive. As the game progresses and you expand into neutral provinces, you expand your forces, laying down groundwork (roads, walls, laser cannons, etc.). You engage in mini-scenarios that allow you to gain rebel forces and cash rewards to aid the cause.

CHECKLIST
Maximum Resolution/Color
640x480 or greater/8-bit
Win95 Native

Fallen Haven's strategy is fairly straightforward. One sure way to kick your enemy's butt is simply to overpower them in unit strength and sheer numbers. The game features 256-color SVGA graphics and the buildings and military units are richly detailed. As far as turn-based games go, *Fallen Haven* is passable.

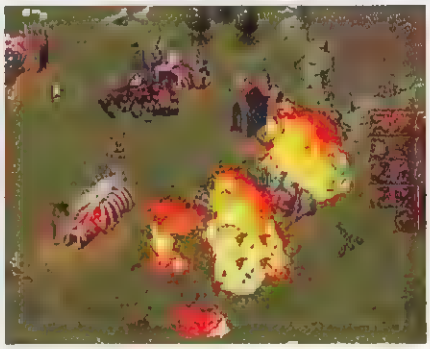
— *Tommy Maple*

Price *$50*
Developer *Micromeg*
Publisher *Interactive Magic*
Phone *800.789.1534*
URL *www.ea.com*

boot verdict 6

Krush, Kill 'N' Destroy

While we're talking about cloning....



The humans take a shot, bombing the Evolved back to the Stone Age—they don't have far to go.

TRY IT ON THE DISC

If laws against cloning were ever extended to computer games, software publishers would be out of business. Witness *Krush Kill, 'N' Destroy*, a shameless rip-off of *Command & Conquer*. It does, however, manage to rise above its "*Road Warrior* meets *C&C*" derivativeness.

KKND takes the hoary old cliché, the post-nuclear wasteland, and applies it to the already overworked real-time strategy game format with effective results. The surviving Humans battle the mutant "Evolved" for control of the planet. The setup allows for some great units, from human bikers, pick-up trucks, snipers, and ATVs to the Evolved army of giant acid-spitting scorpions, mutant wolves, war mastodons, massive attack beetles, and large crabs armed with missile launchers. The units are far more diverse than *C&C* and most of its clones, and they all look sharp. Even more gorgeous are the blasted landscapes, which are some of the best-rendered in any real-time game.

KKND's nicely executed video sequences link and set up the missions. Make sure you watch the text to the right, which is often filled with irrelevant but funny commentary.

Some nuances distinguish *KKND* from the pack. Tech research levels figure heavily into improving units, and battle-scarred units take on a veteran status that makes them more effective. The packaging makes much of the AI of *KKND*, and while it is certainly more aggressive on the attack, it is poor on the defense, which is where a good AI shows its stuff. For the online crowd, strong, stable net play for up to six players makes AI a moot point.

CHECKLIST
Maximum Resolution/Color
640x480/8-bit
MS-DOS
Multiplayer
LAN Modem

Sure, *KKND* is derivative as hell, but it's funny, interesting, and beautifully rendered. Thirty stand-alone, and 10 online missions give it fair playing time, and a genuinely interesting design makes it something you'll actually want to keep playing.

— *Tom McDonald*

Price *$45*
Developer *Beam*
Publisher *Electronic Arts*
Phone *415.571.7171*
URL *www.ea.com*

boot verdict 7

Jack Nicklaus 4

The Golden Bear returns with a vengeance

Jack Nicklaus 4's player interface is clean and unobtrusive, providing precise control of flight trajectory, swing intensity, distance, hooks, and fades.

TRY IT ON THE DISC

Jack Nicklaus 4 is arguably the best golf sim ever. Completely revamped for Win95, this Cinematronics design is not only drop-dead gorgeous and fun to play, but it packs a major wallop: a full-blown, professional-quality course architect guaranteed to delight even the most jaded golf buffs.

Of the 18-hole courses included, four are modeled after real-life links (Colleton River Plantation, Country Club of the South, Muirfeld Village, and Cabo del Sol) while the fictional Winding Springs was created using *JN4*'s course architect. Up to four players—human or computer-controlled—can compete in eight varieties of game, including: Best Score (Championship and Handicap), Match, Stroke, Sudden Death, Skins, Bingo Bango Bongo, and Certified Game (recorded Stroke Play for mail or e-mail matchups). Four multiplayer modes are also supported: serial, LAN, modem, and Internet play.

Cinematronics' proprietary height-mapping engine not only enables exact elevation modeling, but allows subtle details such as terrain self-shading.

Hardcore golf sim fanatics demand realism, and *JN4* delivers. In many regards the audiovisuals dramatically exceed the standards of the current standard bearer, *Links LS*. Don't look for polygon fills or simple Gouraud shading here. Cinematronics' proprietary height-mapping engine achieves unbelievable terrain realism. Objects such are trees and rocks are digitized 2D sprites, MIP-mapped to scale details such as bark and leaves.

In the case of the real-world courses, aerial fly-bys allowed the designers to detect land elevations within six inches of sea level, at one-foot intervals. And unlike a fixed wire mesh, which demands the same level of accuracy regardless of distance, Cinematronics' engine automatically reduces its mapping levels to six-foot intervals for terrain well beyond the maximum drive. The result is nearly instantaneous screen redraws even on a Pentium 100. Incredible, considering that almost two-thirds of a typical screen consists of 3D-rendered terrain. (Compare *that* with most other golf sims!)

Variables such as light-source shading and water reflections are calculated into the mix, producing natural landscapes. Take a closer look and you'll see that the terrain even shades itself! Add to this a physics model that's incredibly flexible, adjusting the ball's flight path and landing reactions to atmospheric conditions, club impact, and terrain type; and precise control that lets you easily adjust ball trajectory, range, fade, and hook.

Naturally, overall speed is contingent on processor speed, system and video RAM, graphic detail, and screen resolution. Although *JN4* doesn't use DirectDraw to support 3D-accelerated video—its graphic engine doesn't need to—it will run at whatever maximum resolution and color depth your video card supports. If the game runs too slowly, try decreasing graphic detail or turning off caddie chatter or ambient sound effects. Another trick is to run the game in a window, by setting its screen resolution lower than that of your desktop. A less aesthetically pleasing alternative is to lower video color depth to 16- or 8-bit.

The only rough spots in *JN4* are a monstrous 171MB initial hard drive installation; the course architect's inability to automatically tile tool palettes and view windows; and you can't test holes without exiting the editor and restarting the game.

Otherwise, *Jack Nicklaus 4* is a masterwork, melding innovative programming with smooth-as-silk gamplay. If you're a golf fanatic, it doesn't get better than this.

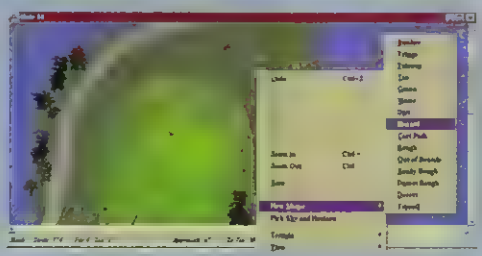
– Scott May

CHECKLIST

Maximum Resolution/Color
1024x768 or greater/16-bit
Win95 Native
DirectX
DirectDraw DirectSound
Multiplayer
LAN modem Internet

JN4 Course Architect

The course architect in *Jack Nicklaus 4*, modeled after Nicklaus Productions' proprietary CAD system, is absolute perfection. A Course Wizard walks newbies through the process, while experienced designers will enjoy complete control of course layout, shape and size; object placement; and terrain elevation. Be warned: This is no kiddie construction set. Though easy to use, it takes time to master. As an added bonus you can import and use the thousands of courses from *Jack Nicklaus Signature Editon* that are freely available on the web.



Every tool of the trade is readily available in *Jack Nicklaus 4*'s built-in course architect, modeled after Nicklaus Productions' own CAD system.

Price $50
Developer Cinematronics
Publisher Accolade
Phone 800.245.7744
URL www.accoldade.com

LEK FutureNote MX200

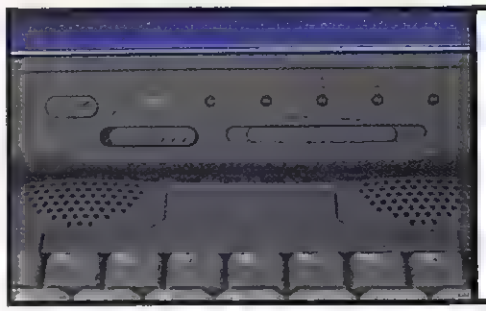
Multimedia muck

Imagine waking up on Christmas morning expecting a brand-new BMX bike, only to find a hamster that suffocated and died before you had a chance to tear open the gift-wrap. Sound harsh? It should—the MX200 certainly is. And considering its pièce de résistance is a 200MHz Pentium with MMX technology, it's also quite possibly one of the worst notebooks ever to run the gauntlet in the bootLab—a complete and utter disappointment.

The MX200 incorporates a desktop 200MHz Pentium processor with MMX technology, 40MB of RAM (nice touch), and a heat sink and fan to push the hot air out the side of the case, effectively cooling the CPU. During the first few boot-ups, the system BIOS duly informed us the system was operating at 200MHz, and things were humming along nicely. But all of a sudden, things began to go wrong. Horribly wrong. As the overall performance started to fluctuate, we noticed the external temperature of the case beginning to rise. After about an hour, the temperature on the bottom of the MX200 was so hot, only a true masochist could touch the notebook. (Suffice it to say, this reviewer can no longer be fingerprinted.)

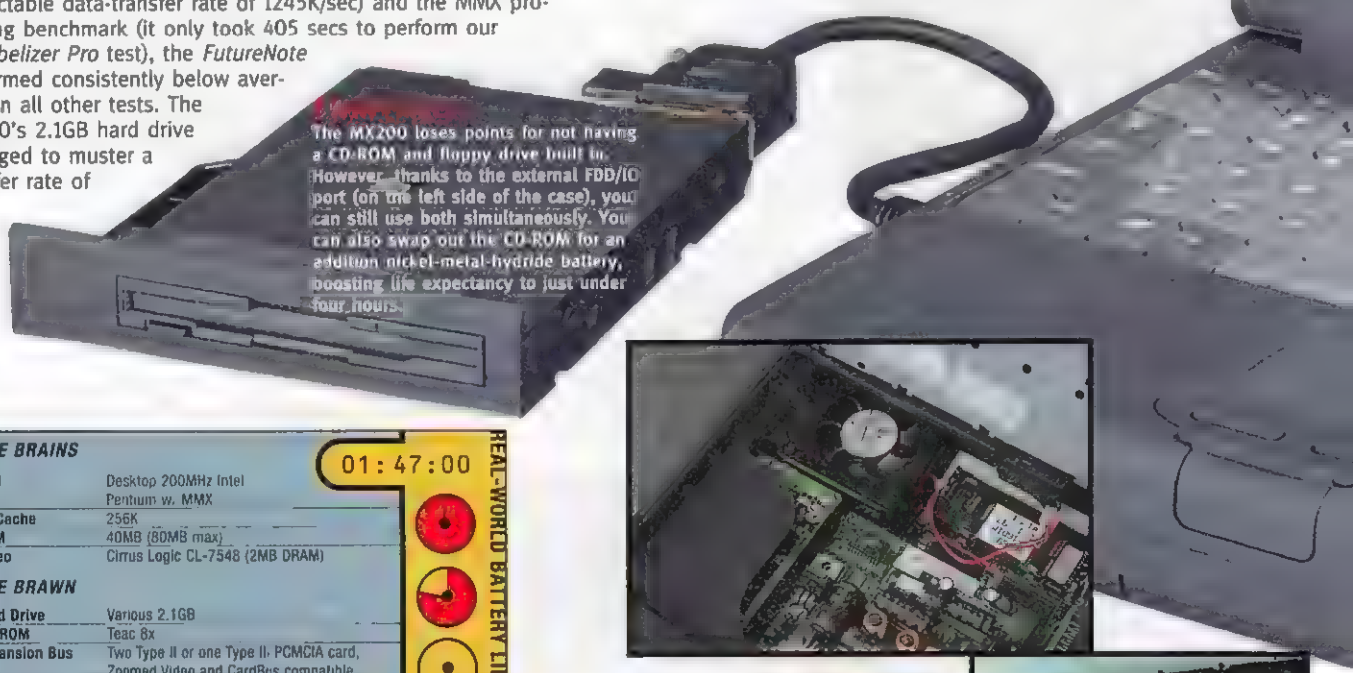
And then the speedy 200MHz processor was, at least according to the system BIOS, now only operating at 166MHz. "Oh no!" cried Mr. Bill. Suspecting overclocking, we cracked the case only to discover there really was a 200MHz processor inside, leading us to believe the problems were due to poor engineering and substandard production.

Except for the zippy CD-ROM drive (which posted a respectable data-transfer rate of 1245K/sec) and the MMX processing benchmark (it only took 405 secs to perform our *DeBabelizer Pro* test), the *FutureNote* performed consistently below average on all other tests. The MX200's 2.1GB hard drive managed to muster a transfer rate of only 1.86MB/sec (consuming a staggering 61 percent of the CPU power in the process), and during our exhaustive AVI video test, more than 90 percent of the frames weren't played. Full-screen MPEG playback was just as bad, with extensive artifacting, pixelation, and atrocious frame rates (at best 10fps). And even after using SciTech's *Display Doctor*, we could coax only 6.9fps out of *Quake* (at 640x480). Simply pathetic.



When it comes to hardware, the MX200 is equally nauseating. The 12.1-inch active-matrix display exhibited an inordinate amount of flex when pressed (even lightly), causing severe screen distortions. It was also annoying to have to power down the machine after shutting down Win95 (most systems do this automatically). There's also no battery management in Win95, no external volume control, only one PS/2 connector, no bundled software, and no gameport.

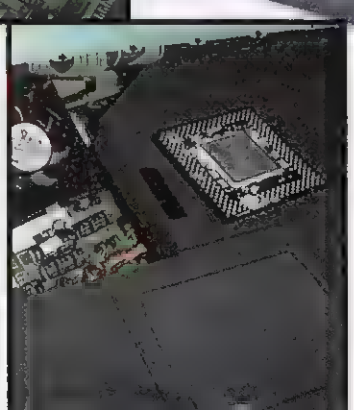
If this is the future of portable computing, we should all be afraid. Very afraid. — *Bryan Del Rizzo*



The MX200 loses points for not having a CD-ROM and floppy drive built in. However, thanks to the external FDD/IO port (on the left side of the case), you can still use both simultaneously. You can also swap out the CD-ROM for an additon nickel-metal-hydride battery, boosting life expectancy to just under four hours.

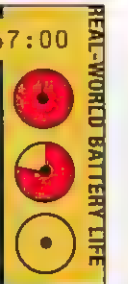
DIM SUM YUM

About the only cool feature on the MX200 is the access to the DIMM sockets and CPU. Lifting up the front panel and removing the keyboard gives you unrestricted access to upgrade the memory (standard DIMMs) or CPU (the processor isn't soldered on, making upgrades very easy). You can also scope out the other integrated components, including the heat sink and processor. However, removing the heat sink or processor voids the warranty. Oops.

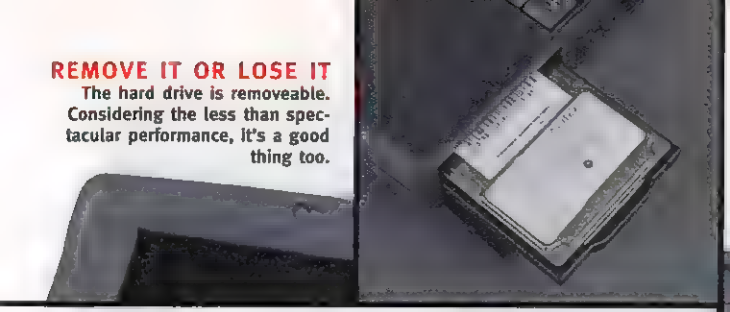


under the hood

THE BRAINS	
CPU	Desktop 200MHz Intel Pentium w. MMX
L2 Cache	256K
RAM	40MB (80MB max)
Video	Cirrus Logic CL-7548 (2MB DRAM)
THE BRAWN	
Hard Drive	Various 2.1GB
CD-ROM	Teac 8x
Expansion Bus	Two Type II or one Type II PCMCIA card, Zoomed Video and CardBus compatible
Lap Weight	7 pounds, 3 ounces
Carrying Weight	8 pounds, 14 ounces
THE BEAUTY	
Display	12.1-inch active matrix
Sound	ESS1688 FM-synthesizer
Video	800x600, 16-bit color (1024x768 w/CRT)
Speakers	Stereo speakers
Communication	IrDA port
THE BUNDLE	None



boot :42 down :3



REMOVE IT OR LOSE IT
The hard drive is removeable. Considering the less than spectacular performance, it's a good thing too.

LEK FutureNote MX200 Users Manual

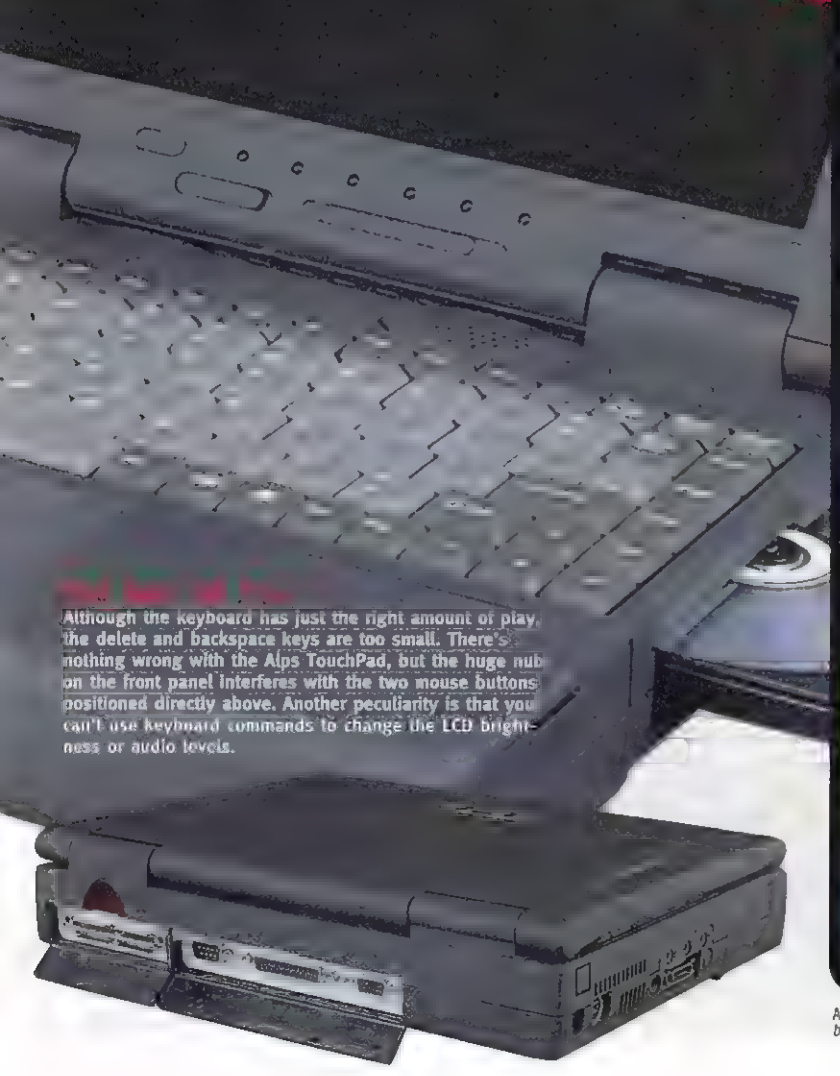
Other keys

n key

n key is located in the bottom-left corner of the keyboard, by holding down the Fn key er with one of the keys that has got a little box, like on F 1 key there is a little box 11 printed inside, generates the function on the "boxed" key.

LITE-BRITE
The brightness slider (next to the power button) is a nice touch, but the resulting adjustment is negligible at best.

LITERATURE NOT
The operating manual that ships with the MX200 is pathetic. Monkeys could do a better job than this. Hopefully LEK will emend it pronto.

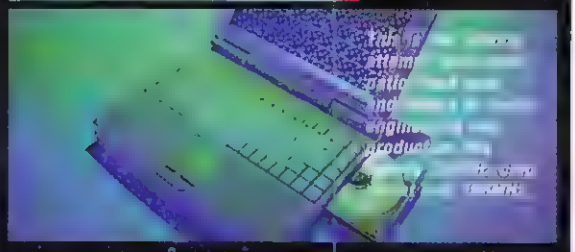


Although the keyboard has just the right amount of play, the delete and backspace keys are too small. There's nothing wrong with the Alps TouchPad, but the huge nub on the front panel interferes with the two mouse buttons positioned directly above. Another peculiarity is that you can't use keyboard commands to change the LCD brightness or audio levels.

real-world benchmarking

LEK FutureNote MX200

CPU/MOTHERBOARD	*bootMark*	33.1
WIN95 APPS	*SYSmark32*	116
DIRECT 3D		no 3D Hardware
HARD DRIVE	*Adaptec ThreadMark v1.0*	MB/sec 1.86
CD-ROM	*CD Tach/Pro v1.65*	K/sec 1245
WIN95 VIDEO	*VidTach v1.52*	% played 9.1
DOS GAMING	*Quake v1.06*	fps 6.9
DIRECTX GAMING	*MDK PerfTest v1.4*	67
MMX PROCESSING	*DeBabelizer Pro*	secs 465
CPU/DISK	*Microsoft Visual C++ compile*	secs 273



+
- 200MHz Pentium w[illegible] (in theory)
- Zoomed Video port
- CardBus compatible
- Composite video-out
- Removable hard drive
- [illegible]

−
- Temperamental processor
- Lousy all-around performance
- FM-synth sound
- No gameport
- Single PS/2 connector
- Poor design
- Floppy and CD-ROM drive swapping
- Poorly written manual

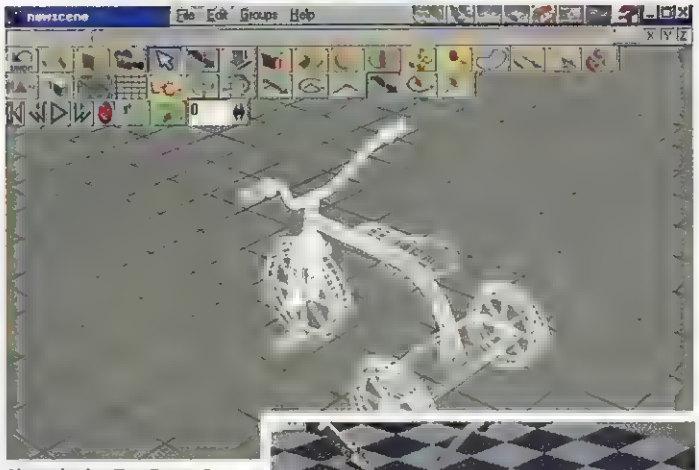
Price $3,695
Company LEK Technologies Inc.
Phone 800.284.8459
URL www.lektech.com

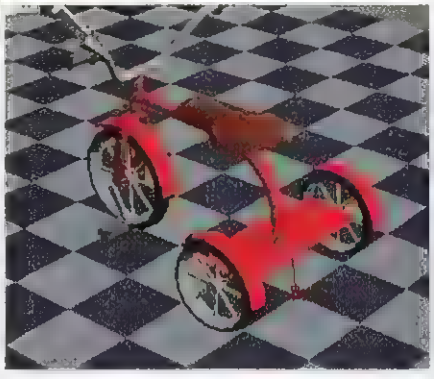
boot verdict 2

A complete breakdown of benchmark results is available on the *bootNet*. Point your browser to www.bootnet.com

TrueSpace 3

True blue





Above is the *TrueSpace 3* default view. At right, the same view with the new Direct3D Display mode turned on.

TrueSpace 3 is the latest incarnation of a veteran program, and while it was always pretty good, the new version is a great improvement.

Among the program's new features is a cool interface which supports Direct3D Display mode. When this mode is on, all objects are displayed as solids instead of the default wireframes. You can also make the gridspace solid and turn on object textures to preview the rendered scene, complete with real-time placement of light sources. If you don't have a Direct3D-capable card, the software emulation mode works well, especially with P166s and up.

Metaball support for primitives such as spheres, cubes, and cylinders is also new to *TrueSpace 3*. By adjusting the attraction and repulsion levels of each object, you can form complex models that would be extremely time consuming to create with traditional modeling techniques. Metaball modeling is especially useful in creating organic shapes, and, unlike other programs, *TrueSpace 3* can model metaballs in real time, letting you view your creation without wasting time rendering.

The most interesting part of the new *TrueSpace* is its physical simulations. Any object in a scene can have physical properties assigned to it, such as those for rubber, Styrofoam, and glass. You can also define the forces, torque, and velocities affecting an object.

When animated, these objects react authentically. Rubber objects bounce realistically, and lightweight objects can be affected by wind sources, so creating an animation of paper blowing in a breeze is easy. And it doesn't take a physics degree to set up these objects. You can also create some interesting effects by setting up objects to defy the laws of nature.

If you have character animation ambitions you'll be interested in the addition of inverse kinematics (IK) support. Take your character model and link the different pieces in a hierarchical chain. When properly defined, the IK chain will let you drag on the end of a group, such as a finger, and have the rest of that chain (hand and arm) move correctly. Using IK makes character animation far easier than with previous versions of the program—it's an addition that's long overdue.

TrueSpace 3 supports VRML more than other desktop 3D packages. It can be a VRML browser, and provides all the modelling and animation tools needed to create VRML worlds including polygon reduction and level-of-detail object viewing.

All the additions to *TrueSpace 3* are useful and well implemented. The program is easy to use and outputs quality results.

— Dave Thomas

Price $795
Developer Caligari Corp.
Publisher Caligari Corp.
Phone 800.351.7620
URL www.caligari.com

Let's Get Physical

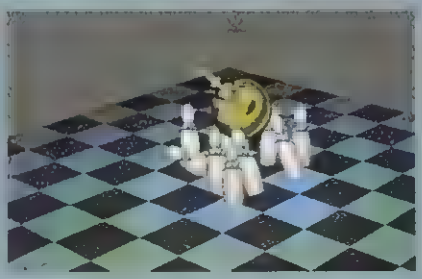
Make some bowling pins with the Lathe tool. Copy your pins and arrange them in the traditional pattern. Next, make a sphere and place it above the pins.

Now go to the Local Physical Simulation tool to assign properties to the objects. Give the ball a property of rubber and each of the pins properties of Styrofoam. While these materials may seem odd for a ball and bowling pins, they work for this demonstration.

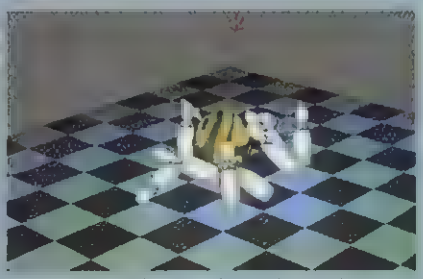
After assigning the properties, go to the Global Physical Simulation tool and make sure that the Set TrueSpace Grid as Gravitation Pad option is turned on.

Open the Animation Control toolbar and click the Start Simulation button. Your ball should fall into the pins, scattering them about. Now try other properties (such as a rubber ball and iron pins, or the other way around).

At the beginning of our bowling pin simulation, the ball is falling toward the ground.



The ball collides with some of the pins.



As the ball hits the ground, the pins continue to scatter realistically.

iM1A2 Abrams

Realism that leaves you shellshocked

Hull down in the Saudi desert waiting for the invaders to appear—a typically tense moment from the Persian Gulf campaign.

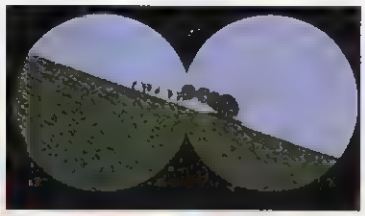
TRY IT ON THE DISC

In 1989, publisher Bill Stealey and designer Arnold Hendrick (both then with MicroProse) teamed up to release the definitive tank sim: *M1 Tank Platoon*. Definitive, at least, until now.

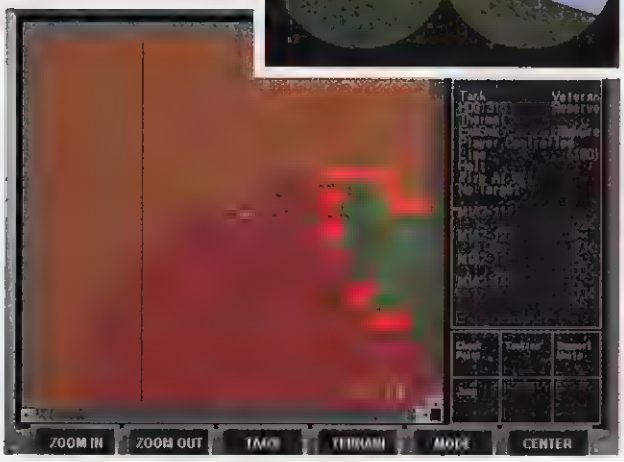
Their sequel, *iM1A2 Abrams*, is simply the best simulation of modern armored warfare you can buy.

The M1A2 is the latest Abrams and the greatest Main Battle Tank in the world. Compared to the original, its gun is more powerful, and it has improved depleted-uranium armor, advanced computer systems for navigation and sighting, and two new types of "smart" munitions (including the top-secret MPAT anti-helicopter round that swats HINDS out of the sky like mosquitoes).

Players familiar with the original will be right at home in the interface; first-timers may initially find it overwhelming (this is, after all, a very high-tech vehicle). Besides using the mouse or joystick to scan for targets, you will issue orders for movement, formation, and viewpoint from numerous pull-up menus, and constantly consult the MFD situation map. Have faith; the controls are logical, ergonomically sound, and easier to use than the originals.



Serbian infantry bailing out of their burning BMP—just one of the many realistic details in *iM1A2*'s scenarios.



Go to the MFD map on maximum zoom to fine-tune your vehicles' positions.

A Quickstart arcade mode serves as a tutorial and allows you to jump right in and start blowing things apart; on the next level, 85 individual missions rendered from digital elevation models of the Balkans, the Ukraine, and the Persian Gulf. The campaigns offer the most challenge. Fight either as a lieutenant (commanding a platoon of four tanks) or as a captain (controlling numerous armored units, support aircraft, and artillery assets).

boot KICK-ASS! PRODUCT

Each battle is set up with fresh variables to ensure excellent replay value (no more prescripted missions). Head-to-head modem play is supported, as is LAN network play for up to 12 people.

I-Magic provides 11 pages of configuration options so you can adjust the features of the 3D world display to suit your hardware. More realism demands more horsepower. Setting the horizon distance to full realism (4,000 meters), for example, dramatically slows things down on any but the fastest Pentiums.

Even with compromises, there's plenty of visual punch: realistic vehicles, terrific explosions and damage effects, plausible terrain modeling, smooth-flying aircraft... the works. Crisp, dramatic audio effects immerse you in a gripping 3D sound-world as well.

CHECKLIST

Maximum Resolution/Color
640x480/8-bit
Win95 Native
DirectX
DirectDraw DirectSound
DirectPlay DirectInput
Multiplayer
LAN Modem

If you're looking for a tank sim with the gestalt of modern armored combat (rather than a glorified arcade shoot 'em-up), *iM1A2 Abrams* gives you everything but the smell of cordite. It's is a classic that surpasses its illustrious predecessor by several orders of magnitude.

— William R. Trotter

Tank Tech 101

boot asked game designer Arnold Hendrick about the technical challenges involved in creating *iM1A2*. The biggest headache, Arnold told us, was the graphics:

"Ground-battle 3D graphics are among the nastiest to program—even worse than flight-sim graphics, because flight sims aren't driving around a half-meter off the ground, and personal combat systems such as *Quake* only look a few meters into the distance. Tank games need to handle close-up terrain, but they also need to show rolling countryside out to a distance of 2,000 to 4,000 meters.

"In *iM1A2* we made major strides in depicting ranges out to 4,000 meters, but we just didn't have the remaining horsepower to handle enough eye-candy vegetation to make a real difference. We included as many trees, buildings, etc., as we could without taking a major hit in frame rate.

"With heavily scripted scenarios with fixed deployments, strongly encouraged movement paths, etc., we could have put all our world objects at carefully selected points to improve appearances. However, for gameplay reasons, our 12-by-12-kilometer battlefields have deployments and battle plans so random that players can end up just about anywhere. Again, we traded eye candy for superior gameplay."

Price $70
Developer Charybdis Entertainment
Publisher Interactive Magic
Phone 800.789.1534
URL www.imagicgames.com

boot verdict 9

Gateway 2000 P5-200 Professional w/MMX

Room to stretch your legs

Nothing's more exciting than a PC built with powerful components, beautiful organic looks, cutting-edge technologies, and an eye for simplicity and expandability. If you appreciate these things, this machine's for you. Despite a few flaws, it's a bold step in the right direction.

The first thing you'll notice is the P5-200 Pro's sleek design. Working in the molded Euro-ergonomic case is a pleasure. To access the insides, simply remove the two big thumbscrews and slide off the side service door. And this is no cheap aluminum siding! Weighing in at nearly 5 pounds, the sturdy steel and plastic panel is twice as heavy as a typical side door. Inside, the ATX formfactor motherboard—jointly designed by Gateway and Intel—uses the Intel 430VX chipset and packs 512K of L2 external cache.

Considerable thought went into this design; as evidenced by the placement of cards, memory, and cache—all neatly stacked and parallel to each other, with enough room between them for emergency repairs. The CPU is snuggled under the case's single quiet fan. Wires plug into the motherboard at the top-right corner where they stream in, leaving the cards unobstructed while providing enough room to park a sports utility vehicle with elbow room to spare.

Of the four PCI slots, two are occupied by the video and sound cards and one is shared with an ISA slot. Of the two dedicated ISA slots, one is taken up by the TelePath 33.6 modem.

One major shortcoming of the P5-200 Pro is its RAM expandability (or lack thereof). The two DIMM slots come with only a single 32MB SDRAM module. Since each slot accepts a maximum of 32MB, your total memory capacity is 64MB. Not practical, considering Win95 really requires 32MB to run decently. Switching to EDO DIMMs, the motherboard will take up to 128MB, but it'll be slower and you'll have to scrap the memory that came with the machine.

The 2.5GB hard drive is divided into two partitions, making it easy to install other operating systems such as WinNT or Unix. DOS drivers should load from the dosstart.bat file when you exit Windows to run in a pure DOS environment, but the P5-200 Pro doesn't include the drivers to access your CD-ROM drive.

Another stumbling block is the video card: the STB Nitro 3D (reviewed on page 98). S3's ViRGE/GX chip fails to deliver any real 3D performance and it lacks VESA 2.0 support, forcing you to rely on memory-resident drivers such as SciTech's *Display Doctor* for high-res gaming in DOS. The ViRGE is a capable 2D card, but the P5-200 Pro's card only has 2MB of RAM. This means the highest resolution you can run in true color is 800x600.

The TelePath 33.6 internal modem contains US Robotics' new x2 technology—even though the manual never mentions it—that promises upgradability to the new 56.6Kbps technology. (There's even a motherboard manual, which includes BIOS settings.)

Also included are Altec Lansing's ACS410 speakers and their ACS251 subwoofer. These pack a decent wallop and should handle any sounds you pump through them. A microphone and stand round out the multimedia offering. The only changes we'd make to the Gateway P5-200 Pro would be to include a 3D accelerator card such as 3Dfx or PowerVR and two more megs of RAM for the STB video card.

— Sean Cleveland

ELBOW ROOM TO THE EXTREME
Cables are neatly tied up and secured at the top of the case, and all of the internal components are spread out on the motherboard with care. Whose says simplicity isn't sophisticated?

under the hood

THE BRAINS	
CPU	Intel Pentium 200 MMX (P55C)
L2 Cache	512K (SRAM cache)
RAM	32MB SDRAM DIMM (64MB max)
Motherboard	Gateway/Intel motherboard with Intel 430VX chipset
THE BRAWN	
Video	64-bit STB Nitro 3D (ViRGE/GX) with 2MB EDO DRAM
Hard Drive	Maxtor DiamondMax 82560A 2.5 GIG ATA 3/E DE
CD-ROM	Mitsumi FX140S 12x min/ 16x max ATAPI DE
Expansion Bus	Four PCI slots, three ISA, one PCI/ISA shared
Fax/Modem	Interna TelePath 33.6 Data, 14.4 Fax Modem for Windows with x2 Technology
I/O Ports	Two USB ports, two serial ports, one parallel port
THE BEAUTY	
Display	Crystalscan 700 17-inch (15.9-inch viewable) 0.28mm dot pitch (max res of 1280x1024 @ 50Hz)
Sound	16-bit Ensoniq AudioPCI
Speakers	Altec Lansing ACS410 speakers with ACS251 subwoofer
Case	ATX formfactor; removable side service door; three 3.5-inch internal expansion bays; two 5.25-inch and one 3.5-inch external expansion bays with snap-off door cover

THE BUNDLE Windows 95 (OSR/2) ▮ MS Money 97 ▮ MS Office 97 (Small Office Edition) ▮ MS Automap Streets Plus ▮ MS Encarta 97

boot	down
:46	:4

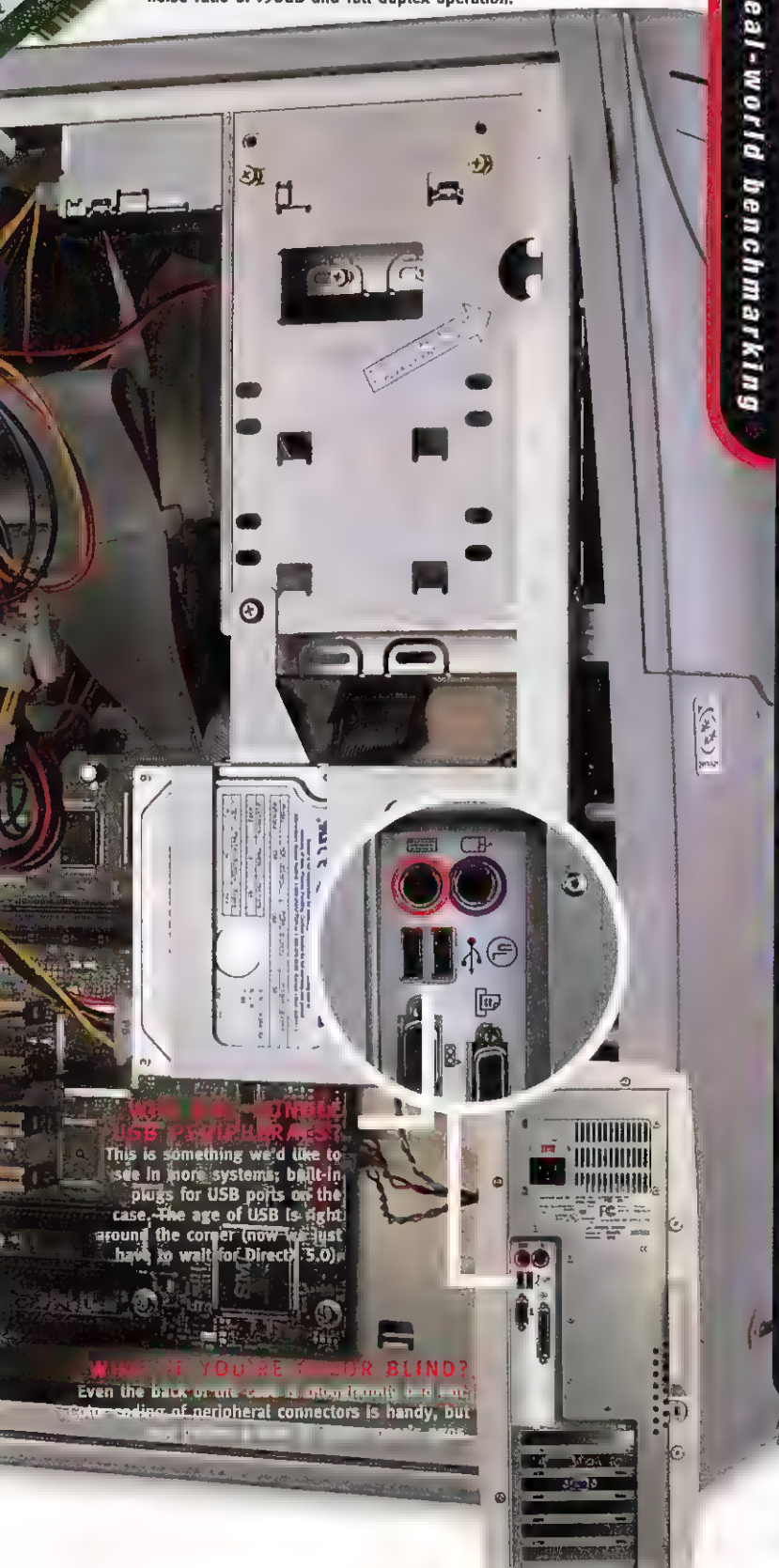
The DMA or Not To DMA

The Mitsumi CD-ROM drive offers full DMA bus-mastering support. But with the new OSR/2 release of Win95, it must be manually engaged because Gateway doesn't enable it. We tested the P5-200 Pro with bus mastering on and off.

CPU Utilization	DMA OFF	DMA ON
2x Speed (300Kps)	7%	2%
4x Speed (600Kps)	14%	3%
6x Speed (1200Kps)	21%	5%
8x Speed (1200Kps)	27%	6%
12x Speed (1800Kps)	100%	9%
Seek/Read Tests		
Full Stroke	846ms	204ms
Random Access	136ms	123ms

IT'S A MAGIC BUS

In a surprisingly radical move, Gateway included a PCI sound card. The benefit of using PCI over ISA is the reduced overhead, both in utilization and in wait states. We tested the CPU utilization at 10 percent (average ISA sound cards test between 12 and 20 percent). Performance is dramatically increased by abandoning the ancient ISA bus. Other features include support for up to 32 simultaneous voices, 16 MIDI channels, 16-bit Record/Playback at up to 48kHz (mono/stereo), a signal-to-noise ratio of >90dB and full duplex operation.



WOW, IT'S [illegible] USB PERIPHERALS!

This is something we'd like to see in more systems: built-in plugs for USB ports on the case. The age of USB is right around the corner (now we just have to wait for DirectX 5.0).

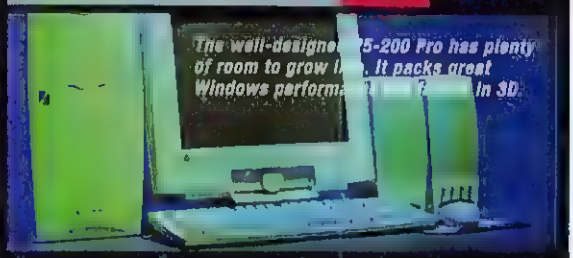
WHY, IF YOU'RE [illegible] OUR BLIND?

Even the back of the case is [illegible] but color-coding of peripheral connectors is handy, but

real-world benchmarking

Gateway 2000 P5-200 Pro w/MMX

CPU/MOTHERBOARD	bootMark	55.7
WIN95 APPS	SYSmark32	186
DIRECT 3D	TerraMark	0 failed to run
HARD DRIVE	Adaptec ThreadMark v1.0	MB/sec 3.41
CD-ROM	CD Tach/Pro v1.65	K/sec 2208
WIN95 VIDEO	VidTach v1.52	% played 39
DOS GAMING	Quake v1.06	fps 15.7
DIRECTX GAMING	MDK PerfTest v1.4	81
MMX PROCESSING	DeBabelizer Pro	secs 363
CPU/DISK	Microsoft Visual C++ compile	secs 182



+

- Ensoniq AudioPCI sound card
- ATX formfactor design with lots of space inside the case
- Two free PCI slots and two free ISA slots
- Altec Lansing speakers and subwoofer

−

- EDO video with no VESA 2.0 support and only 2MB of RAM onboard
- Upgradable to a maximum of 64MB of RAM

Price $2,449
Company Gateway 2000
Phone 800.846.4208
URL www.gw2k.com

boot verdict **8**

A complete breakdown of benchmark results is available on the *bootNet*. Point your browser to www.bootnet.com

Fujitsu DynaMO 640

That's magneto-optical, you knucklehead

MO drives are the Stooges of removable-cartridge devices, possessing neither the rugged versatility of phase-change drives nor the ripping high speeds and capacities of purely magnetic drives. MOs are reliable, which makes them about as exciting as a poke in the eye. They receive only slightly more respect than Larry and Curly drives. Flashier drives, such as Iomega's Jaz, may get the lead roles, but that doesn't mean MO drives should be left on the cutting-room floor.

Overall, the Fujitsu DynaMO 640 falls somewhere in the Shemp range. The external SCSI II device ships with three 640MB discs, but not with a SCSI adapter. The driver software includes a disc-prep utility supporting two formats: the Super Floppy format, which is the most common; and the Fixed Disk format, which allows multiple partitions (but is only recognized by proprietary Fujitsu drivers).

The DynaMO performed passably in our performance tests. Opening a 50MB Photoshop TIF took 1 minute and 57 seconds, and capturing 20 seconds of full-screen video directly to DynaMO resulted in a disappointing 59 dropped frames. Fujitsu's new direct-overwrite technology improves the drive's write performance with a sustained write speed of 1100K/sec that complements the drive's sustained read rate of 1360K/sec. Copying 109MB of data to and from the drive took 2 minutes, 49 seconds and 1 minute, 8 seconds respectively. We got the slowest transfer rates when copying 109MB to a Super Floppy-formatted disc, such as the 4 minutes, 7 seconds it took to move 98MB to the drive.

The DynaMO 640 isn't the fastest drive we've seen, and it has the worst haircut.

Hey Moe, how come MO cartridges look like CDs encased in plastic?

MO Technology 101

Like their CD cousins, MO discs are encapsulated in a layer of plastic. The difference lies in the magnetic particles that lie beneath the surface. When an MO drive records data, the laser first heats and softens the plastic, then a strong magnetic current aligns the polarity of the surface particles. After the plastic cools and hardens, the particles freeze in place with the new magnetic orientation. A less-powerful laser reads these magnetic pits and grooves. MO drives crash less often because their read/write head is placed farther from the disc, and the discs are less prone to failure because the material can only change after the plastic is heated and softened.

The ability to exchange data is an important part of portable storage media success. The Fujitsu DynaMO 640 is the first drive in this standard so its level of market penetration remains to be seen.

Dare to Compare

	Iomega Jaz	SyQuest SyJet	DynaMO 640
Capacity	1.0GB	1.5GB	640MB
Price of Drive	$500	$499	$659
Price of Cartridge	$99	$125	$200/5 discs
Price per MB	10¢	8¢	6¢
PERFORMANCE TESTS			
Photoshop (min, sec)	1:31	1:35	1:57
98MB transfer to MO (min, sec)	2:23	2:00	2:49
98MB transfer from MO (min, sec)	0:50	0:51	1:08
Video Capture (dropped frames)	6	5	59

As part of the Orange Book standard (the same standard that makes CD-R discs readable in CD-ROM drives), all 640MB MO drives are designed to work with each other. Besides being the only drive to use the new 640MB 3.5-media, the DynaMO 640 reads and writes to 230MB discs and reads 128MB discs.

While the DynaMO 640 is far from being the Stooge with the spittoon haircut, it soitenly won't throw your data into a vise or smack off your nose. If reliability is your gig, this drive is for you.

— Sean Downey

Price $659
Company Fujitsu
Phone 800.626.4686
URL www.fujitsu.com

boot verdict 7

Wireless Web Wonders

Keepin' one hand busy

Unfetter your cursor-pushing pleasure. You wanna surf the Usenets from the luxury of your new Corinthian leather couch? Something here's bound to make you think twice about chucking that old, played-out mouse.

— Andrew Sanchez

SurfMan

Logitech's SurfMan puts the power of wireless web surfing in the palm of your hand.

The ergonomically tailored ebony controller places a trackball and three buttons within thumb's reach, while the puny package weighs in at a mere 4.3 ounces.

With its radio frequency technology, the SurfMan's not tethered by line-of-sight to the small, rectangular receiver. In the bootLab, we're able to get a low-range measurement of about 5 feet, while long range peters out at around 15 feet. Power consumption (from the two AAA batteries) varies depending on which setting you choose. If you don't plan to surf the net from 20 feet away, keep the power setting on low.

An additional SurfMan or Cordless Mouseman Pro (reviewed in *boot* 09) can be simultaneously hooked up to enjoy the best of both cursor-controlling worlds.

An integral part of the SurfMan is the enhanced, bundled utilities. In addition to the high level of programmability, Netscape users are blessed with the *CyberJump* utility, which allows you one-button access to your bookmarks, the horizontal and vertical scroll bars, and more. Netscape *Communicator* users will have to wait for an update to *CyberJump*, because functions such as bookmark accessing aren't currently accessible.

Mouse Properties
Quick Setup | Pointers | Buttons | Motion | Orientation | Devices
Device Information
Use the selection box below to choose a device to work on. Any new changes will be saved to the selected device.
Cordless MouseMan Pro on the COM2 Port
Setup
Press the ADD DEVICE button to check for newly installed pointing devices
Add Device
Version Information
Logitech MouseWare Control Center
Control Center version: 7.20
Mouse Driver version: 7.20
Copyright (c) 1991-1996 Logitech Inc.
LOGITECH
OK
Cancel
Apply
Help

With Logitech's control panel, you can reprogram those three mouse buttons in an instant.

The SurfMan is a niche product, designed for easy web browsing rather than cutting and pasting in *Word*. For what it's worth, the tiny trackball suffers from almost zero latency, resulting in responsive cursor control.

If you're a web lunatic, take the SurfMan for a ride, but don't try fragging anyone in *Quake* with it. (Although you are welcome to try.)

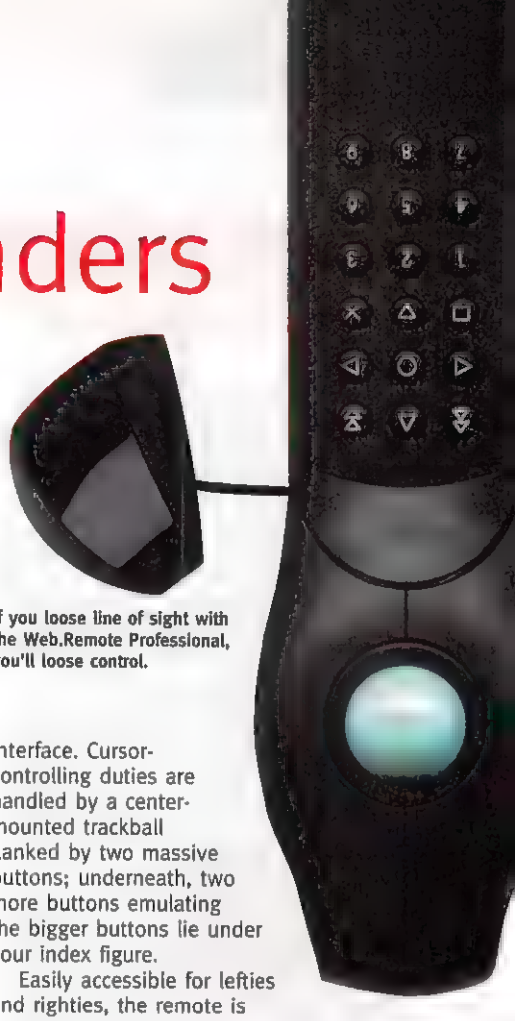
Price $100
Company Logitech
Phone 800.231.7717
URL www.logitech.com

It may look like a Federation phaser, but the SurfMan's designed for one-handed Internet surfing.

Web.Remote Professional

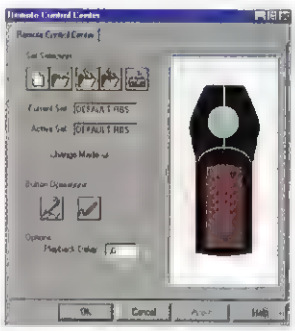
InterAct enters the wild wireless west with their Web.Remote Professional. This handheld remote puts wireless programming in the palm of your hand.

A bounty of buttons populate the 5.3-ounce infrared remote, with 18 rubber buttons ready for your programming pleasure. From a single keystroke to fully-fledged URLs, these keys are simple to program thanks to an easy-to-use Win95 interface. Cursor-controlling duties are handled by a center-mounted trackball flanked by two massive buttons; underneath, two more buttons emulating the bigger buttons lie under your index figure.



If you loose line of sight with the Web.Remote Professional, you'll loose control.

Easily accessible for lefties and righties, the remote is a wrist-straining experience thanks to a killer combo of non-ergonomic design and the required two AA batteries that rest in the lower end of the remote. Also, a clear line of sight must be maintained for the remote to effectively communicate with the desk-mounted receiver. Even pointing the unit at slightly odd angles near the receiver causes the unit to tweak. We were able to squeeze about 12 to 13 feet until the remote petered out.



Your favorite URLs can now be programmed into a single rubber button with this easy-to-use interface.

While we appreciate the cool custom programmability, we can do without the strained wrist action and ungainly feel.

Price $80
Company InterAct
Phone 800.732.6866
URL www.interact-acc.com

Magic: The Gathering

Dueling with yourself

TRY IT ON THE DISC

MicroProse's *Magic: The Gathering* is the complete card game, accurately captured on your computer screen. The entire 400-card fourth-edition set has been beautifully scanned and coded, plus an additional 20 out-of-print cards and a 12-card Astral set exclusive to the PC game. If you've never played Magic before, the 200-page manual and multimedia tutorial will bring you up to speed in no time.

To put the dueling in context, you can start as an apprentice wizard with a meager deck. Try to build up power and allies to defeat the growing evil in the land, duel for ante, and buy, sell, quest, and trade for more powerful cards. This is much less contrived than it sounds, and the role-playing elements make up for the lack of multiplayer modes.

***Magic: The Gathering*'s dueling field realistically simulates the card game experience.**

The game's AI could have been done better. It doesn't learn as it plays, and its strategy is based on the current play, not anticipating events or planning for killer combinations. Still, it plays a pretty mean game and even experienced players will be engaged.

— Chris Dunphy

CHECKLIST

Maximum Resolution/Color
800x600 or greater/24-bit
Win95 Native
DirectX
DirectDraw DirectSound

Price ***$50***
Developer ***MicroProse***
Publisher ***MicroProse***
Phone ***800.695.4263***
URL ***www.microprose.com***

boot verdict 8

MTG-BattleMage

Magic is an awesome card game and it could easily be an excellent action game. But by trying to be both at once, *Magic: The Gathering–BattleMage* fails in every regard.

The game feeds you a new card every 15 seconds—less time than it usually takes to cast and target a spell—which results in half your cards being discarded because you can only have seven spells in your hand at a time. Then, while you're fumbling around, the computer player is killing you with clockwork precision.

The graphics are cheesy at best, and at worst are unrecognizable. Even the multiplayer network mode is not enough to save this bomb.

It seems *MTG–BattleMage* was never playtested. It's unplayable.

Price ***$50***
Developer ***Acclaim***
Publisher ***Acclaim***
Phone ***516.656.5000***
URL ***www.acclaimnation.com***

boot verdict 1

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boot

ViRGE of Greatness

Second-generation boards are still weak

The first-generation ViRGE chip (and its VRAM brother, the ViRGE/VX) made few friends in the bootLab. Though it did possess some excellent 2D punch, its 3D performance is better described as "deceleration." Its low-quality scaled video left us cringing, and the lack of built-in VESA 2.0 had us scrambling for UniVBE. Despite this, thanks to S3's market dominance, there are now more than 5 million people who mistakenly think that they have 3D oomph on their desks.

The second generation of the ViRGE (the ViRGE/DX with DRAM and ViRGE/GX which adds SGRAM support) has arrived, and at last it has a good (although not ATI-style great) video scaler and provides significantly better 3D performance. Amazingly, VESA 2.0 support is not yet provided by S3, and only the Stealth 3D could run Quake *at 640x480 without UniVBE.*

Though ViRGE may have crept out of the 3D-deceleration category—now delivering a poor-though-playable 10fps to 15fps in Hellbender *for example—there is certainly no mistaking it for a 3D accelerator.*

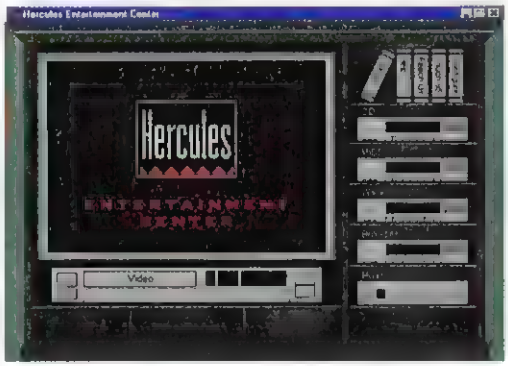
— Chris Dunphy

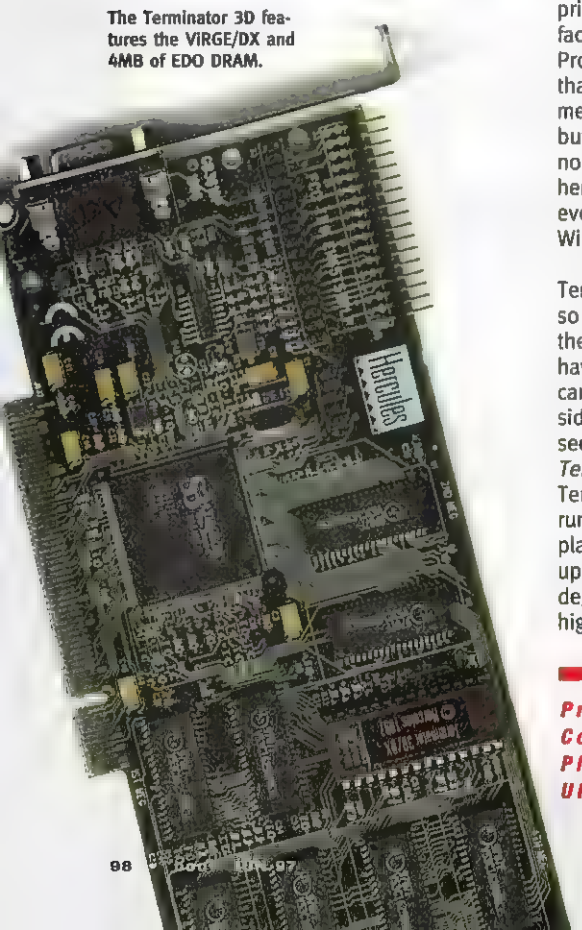
Hercules Terminator 3D/DX

The latest Terminator 3D board features a ViRGE/DX chip partnered with 4MB of EDO DRAM. The only bundled software is ViRGE-enhanced *Descent 2: Destination Quartzon*—it looks OK, but peaks at an uninspiring 15fps. Sadly, *D2* is the most compelling thing about this package.

The drivers for the Terminator 3D/DX are among the most primitive we have seen. The Touch95 interface does not integrate into the Display Properties control panel, and has a less-than-polished feel. The Hercules Entertainment Center on the other hand, is polished but useless. Why would anyone want a nonresizable stereo rack sitting on his or her desktop—particularly one that doesn't even recognize long file names? (Will Windows 3.1 programs *ever* leave us?)

Like all the other ViRGE boards, the Terminator delivers solid 2D numbers. But so does any other modern card. At all but the highest resolutions, 2D speed problems have been solved, and your eyes certainly can't see much difference. But on the 3D side of things, your eyes can't help but see the glaring flaws of the Terminator. *Terracide* ran at less than 5fps, and our TerraMark and Wizmark tests refused to run at all. At least the AVI and MPEG video playback looked good, scaling up to full-screen without degrading at all but the highest resolutions.





The Terminator 3D features the ViRGE/DX and 4MB of EDO DRAM.

Price *$149 (4MB)*
Company *Hercules*
Phone *800.532.0600*
URL *www.hercules.com*

Diamond Stealth 3D 2000 Pro

Some games are better bigger, like on a television, and the newest ViRGE/DX-powered Stealth 3D 2000 simulcasts your computer's display onto any big screen for the ultimate in social gaming. S-video and composite connectors are provided, but there is a catch.

The television-out is enabled if, at power-up, the Stealth 3D detects anything plugged into its video port. If it does, it automatically switches to resolutions of 800x600 and less. If you want to work in a higher-resolution mode, you must crawl behind your computer to unplug the video cable, then turn off your system and reboot. This is uncalled for. At least the quality of the TV-out is good, with very little flicker. With the proper font, text is legible on a common household television even at 800x600.

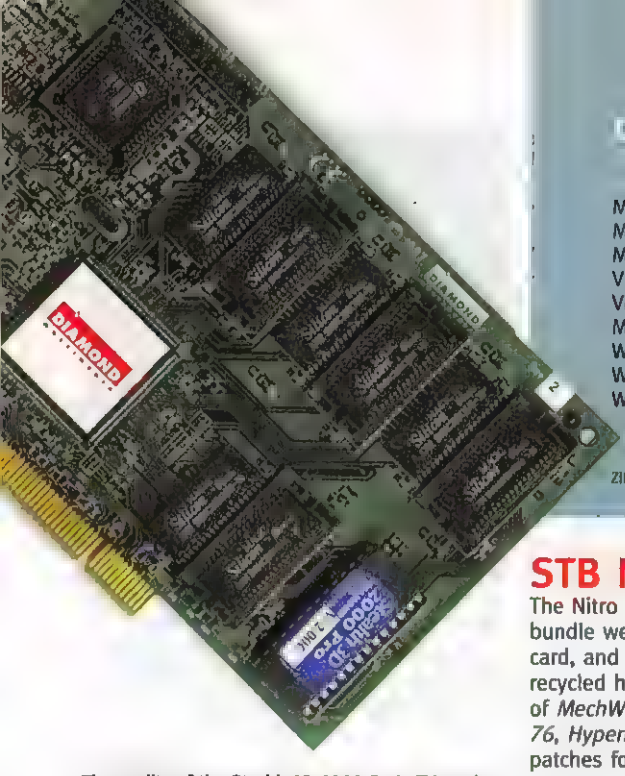
Diamond's drivers and display utilities are polished and optimized, perhaps too much. The 2D speed was at the top of our charts, but video, when scaled to near full screen, becomes corrupted. On the 3D side, the Stealth 3D actually played *Terracide* at a very smooth 20fps, but for some reason *MotoRace* failed to recognize that

TNT? Try's on Chrome!

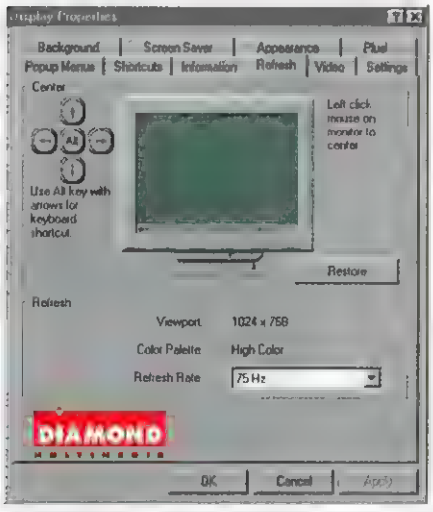
S3 has just announced the third generation of the ViRGE architecture, the ViRGE/GX2, and it looks like at last they may be onto something exciting. Using the same core architecture as the mobile ViRGE/MX previewed in this issue (see page 58), the GX2-provides dual-screen support, integrated TV-out, better video, and more 3D speed. Look for GX2-based boards to appear later this year.

	Terminator 3D	Nitro 3D	Stealth 3D
Max 24-bit Resolution/Refresh (Hz)	1024x768/90	1024x768/75	1024x768/100
Max 16-bit Resolution/Refresh (Hz)	1280x1024/75	1280x1024/85	1280x1024/75
Max 8-bit Resolution/Refresh (Hz)	1600x1200/60	1600x1200/60	1600x1200/65
VESA 2.0 Support	No	No	Yes
Virtual Desktop Support	Yes	Yes	No
MDK PerfTest	94	95	96
WinMark 97 10x7x16	76.2 / 29.5	74.4 / 36.7	80.2 / 39.3
WinMark 97 10x7x24	57.1 / 25.4	62.6 / 33.2	62.5 / 32.9
WinMark 97 12x10x16	68.9 / 28.6	71.9 /36.2	74.8 / 38.1
Quake 640x480	15.9fps	15.9fps	15.9fps
Quake 800x600	10.2fps	10.5fps	10.4fps

Ziff-Davis Business Graphics WinMarks/High-end Graphics WinMarks



The quality of the Stealth 3D 2000 Pro's TV-out is great, though it would be nice to be able to turn it off with software rather than a reboot.



the card is Direct3D compatible, and Terramarks also refused to run.

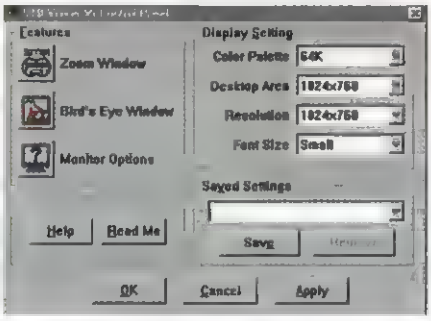
No 3D-accelerated titles are bundled, but MGI's *PhotoSuite SE*, a demo version of *Sega Rally*, the Microsoft *Game Sampler 2*, and *Compton's 96 Interactive Encyclopedia* are. If television output is what your PC craves, this card does the job well. But then, ATI cards have been doing it better for the last six months.

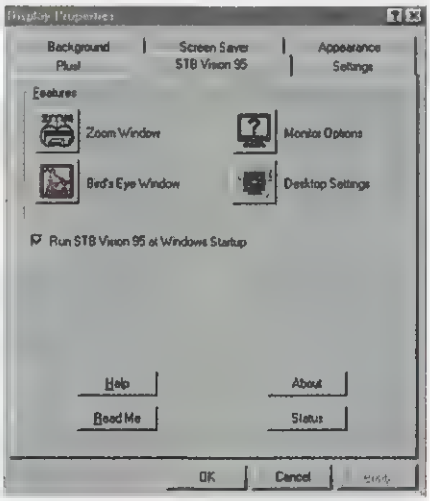
Price *$199 (4MB)*
Company *Diamond Multimedia*
Phone *800.468.5846*
URL *www.diamondmm.com*

STB Nitro 3D

The Nitro 3D comes with the best software bundle we've ever seen with a graphics card, and these aren't just last year's recycled hits. Included are full-versions of *MechWarrior 2: Mercenaries*, *Interstate 76*, *Hyperblade*, and *Spycraft*. Direct3D patches for *Mercenaries* and *I-76* were not ready at ship time, however, so only *Hyperblade* takes advantage of 3D acceleration, but all of the games look and play great.

Unlike the other boards in this roundup, the Nitro is equipped with the ViRGE/GX—but it doesn't use SGRAM. An STB engineer said that at the slow-memory bus speed of the ViRGE, SGRAM would not have provided any performance boost





Though it uses the ViRGE/GX, the Nitro 3D chose to go with EDO DRAM rather than SGRAM.

over EDO DRAM. The board comes in both 2MB (upgradable) and 4MB flavors, with the less-expensive version sacrificing *I-76* and *Spycraft* from the bundle.

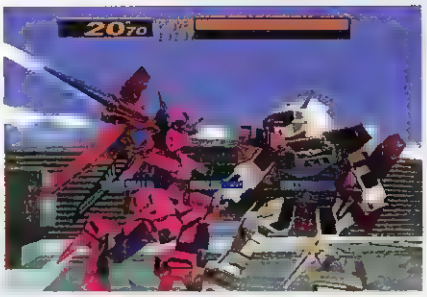
The Nitro drivers and display utility are well behaved and functional, and if you use the virtual desktop you can enable a nifty overview window that shows your entire workspace at a glance. VESA 2.0 is sorely lacking, though, as is Direct3D compatibility. All our 3D benchmarking programs failed to run, but *Hellbender* and *Hyperblade* did benefit noticeably from the 3D enhancements.

The Nitro 3D's bundle is so good it's almost like you're buying the games and getting a 3D card for free. If you think of it that way, this is not a bad deal.

Price *4MB $149; 2MB $99*
Company *STB Systems*
Phone *888.234.8750*
URL *www.stb.com*

Cyber Trooper Virtual On

Mechs never get along



Why can't mechs just get along? *Virtual On* gives you a reason to kick some metallic ass.

Crush all comers with your metallic fist in *Cyber Trooper Virtual On*, the latest Sega arcade sensation to make the jump to the PC platform.

For those not hip to the arcade game, *Virtual On* is an arena-style 3D fighting game with a choice of mech variants. What makes it unique is the combat: battle is peppered with a variety of projectile weapons, including plasma beams and missiles. Jump-jets allow you to leap out of harm's way and drop in for a little personal payback. When you get close to your foe, the game switches to close-combat mode where you swing energy swords and iron fists in your quest to loosen the screws of your equally armed opponent.

Graphics remain true to the arcade version, operating within an SVGA 16-bit texture-mapped polygon world with mechs sporting their obligatory Gundam/Anime-inspired designs. The occasional 2D sprite appears in the form of a tree or canned explosions.

Even with MMX, *Virtual On* does not possess the silky smooth, 60fps, 640x480 graphical blowout of the arcade version. With the full screen enabled and all the fixings, *Virtual On* maintains frame rates ranging from 13fps to about 20fps, depending on the mechs and the terrain. Shrinking the screen size helps, but bringing the resolution down to 320x240 really accelerates the frame rate. However, this is at the expense of visual clarity and the world deteriorates into a mass of heaving pixels. Too bad Sega relies on that crappy checkered pattern to simulate semitransparencies. If they had gunned for some ultrasmooth frame rates and the filtering that 3Dfx *Pod* achieves, they would have outdone themselves.

Trying to master *Virtual On* with a keyboard is one of the most trying experiences ever conceived, considering the arcade controls consisted of two flight sticks. If you happen to have two sticks and a Y-jack, use them. Otherwise you're left fiddling around with a SideWinder game pad, or worse.

Sega's getting close. But close only counts in horseshoes and hand grenades, not arcade-to-home conversions.

— Andrew Sanchez

CHECKLIST

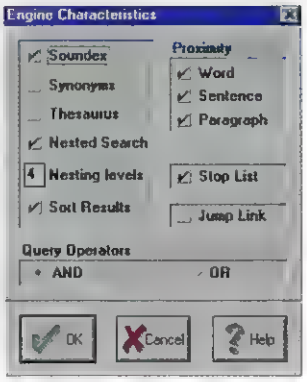
Maximum Resolution/Color
640x480/16-bit
DirectX
DirectDraw DirectPlay
Multiplayer
LAN Split screen
MMX Enhanced

Price ***$48***
Developer ***Sega of Japan PC Division***
Publisher ***Sega Entertainment***
Phone ***800.872.7342***
URL ***www.sega.com***

boot verdict 7

Insight Into Information

Fighting an uphill battle



Insight Into Information sports definable engine characteristics.

Enigma's *Insight Into Information*, a seriously pricey product, isn't the most enjoyable way to be kept up late at night. The rewards *might* be worth the hassle, though.

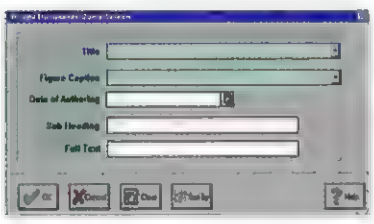
See if you fit this description: You have boatloads of documents you want to make widely available in a fully searchable format, and they're not already managed by a mainstream database (e.g., Oracle, Sybase), or easily translated into HTML. *Insight* essentially allows you to get all these documents into a database, construct a customized GUI front-end, and deploy the resulting application via CD-ROM or the web. The thing is, you have to use *Insight*'s Creator to build your GUI, and it's buggy and strange, not to mention annoyingly Win95 unsavvy. For example, Creator's main window insists on being permanently maximized, forcing you to choose between viewing either the button bar at the bottom of its window or the taskbar. It doesn't support undo or long filenames, either.

On the upside, *Insight*'s Administrator supports almost every document format in existence, and once you've established how to map from the elements in your source documents to the fields of your database, mass document conversion is easy via batch scripts.

You can include multimedia documents as well, such as WAV and AVI files. The *NetSight* server software generates HTML on the fly from your database's contents. Burning a CD with your content or title is also a snap; *Insight* generates a table of contents, compresses your data, and organizes it for duplication.

If you're not ready to spring for one of the popular databases, check out *Insight Into Information*. But be warned: It ain't gonna be easy.

— Neil Redding



Build queries based on multiple criteria.

Price ***$7,500***
Developer ***Enigma Information Retrieval Systems Inc.***
Publisher ***Enigma Information Retrieval Systems Inc.***
Phone ***617.239.8729***
URL ***www.enigmainc.com***

boot verdict 4

BUILD for Today

Two new games just wanna frag you up

Don't dismiss that pesky ray-cast first-person BUILD gaming engine yet! Duke Nukem 3D*'s heart still beats, thanks to Interplay's* Redneck Rampage *and GT Interactive's* Blood.
— Andrew Sanchez

Kick some alien butt in *Redneck Rampage.*

Blood

TRY IT ON THE DISC

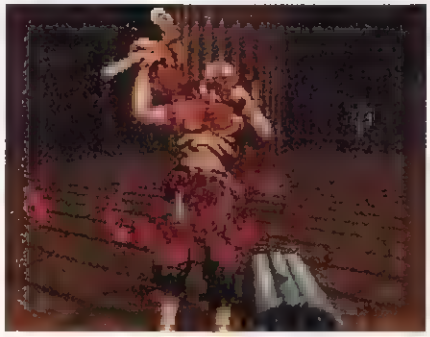
If it isn't belligerent aliens, then it's some insane god named Tchernobog who wants to make a snuff film of humanity. Enter one pissed-off former servant, resurrected and ready to exact revenge, and you have *Blood.*

Your journey toward redemption is littered with all manner of demonic terrors. But don't worry, 'cause you have righteous vengeance and a bevy of firepower to aid you. In addition to the standard fragging fare—the stereotypical double-barreled shotgun—other weapons at your disposal, such as the voodoo doll, lend a campy feel to the game; and flambé-inducing weaponry will have your foes dancing the cinder cucaracha in no time. Power-ups such as the "guns akimbo" will have you dealing double-fisted death, including decapitations!

Blood's 256-colored SVGA world swims in brown hues which contrast with the cold, blood-splattered walls and gray bit-mapped skies. Unfortunately, the mid-res texture maps pixelate, unlike *Redneck Rampage*'s extra-crisp, high-res textures.

Like all BUILD-based games, most objects are scaling sprites, and as a result, frame rates were smooth on all our test systems.

The BUILD engine is a work-in-progress, each developer pushing it to do things never seen before, and *Blood* is no exception. Sector stacking is flawless, and the "in-game 3D sprites" technology (similar to voxel graphics) allows *Blood* to produce volume-pixelated objects that rotate perfectly.



Don't mess with *Blood*'s double-barreled shotgun.

The levels are devilishly hard to complete, but in case you get bored, there's an easy-to-use level editor. And the soundtrack's ethereal instrumental whispers and mournful chants deserve special mention.

While it may not look as sharp as its BUILD brethren, *Blood*'s intriguing combination of frantic cap peeling, smartly designed levels, cool weaponry, and unearthly music will have you bathing in gore and loving every minute of it.

CHECKLIST

Maximum Resolution/Color
800x600/8-bit

Multiplayer
LAN modem Internet

Price ***$50***
Developer ***3D Realms***
Publisher ***GT Interactive***
Phone ***800.469.5961***
URL ***www.gtinteractive.com***

boot verdict 8

Redneck Rampage

TRY IT ON THE DISC

Pistol-packin', pig-lovin' good ol' boys get down and dirty in *Redneck Rampage*, a balls-to-the-wall first-person shooter with a simple quest: Save your beloved porker from aliens bent on world domination.

Xatrix spared no expense in redecorating the BUILD engine. The developers rewrote portions of the BUILD editor to increase level sizes and made use of sector stacking and free-standing polygon objects.

Graphics can be stretched to an unbelievable 1280x1024, but most folks will be down with 800x600 and frame rates of more than 20fps.

Visually, *Redneck Rampage* is the cleanest BUILD-based game due to its texture maps, which reach as high as 256x256 pixels, and up to 200 frames of animation are used for the game's vagrant characters.

CHECKLIST

Maximum Resolution/Color
1280x1024/8-bit

Multiplayer
LAN modem direct/serial
Internet

Building upon *Duke Nukem 3D*'s interactive environments, *Rampage* lets you molest chickens that get in your way and indulge in cow tipping while accompanied by the soundtrack's hard-hitting mix of Southern rock.

The enemy AI reacts to sounds, so don't expect to sneak up on anybody if you're banging along atop a sheet-metal roof.

On top of a mountain of gore, *Redneck Rampage* has, some of the foulest language ever to hit a PC game.

In a sea filled with the children of BUILD, *Redneck Rampage* packs enough attitude, outrageous enemies, and gore-laden action to stand as *Duke*'s country cousin.

Price ***$60***
Developer ***Xatrix***
Publisher ***Interplay***
Phone ***800.468.3772***
URL ***www.interplay.com***

boot verdict 9

TRY IT ON THE DISC

With the never-ending parade of legitimate and illegitimate add-on discs for *Duke Nukem 3D* littering store shelves, it seems that you just can't get enough alien ass-kicking. Now WizardWorks unleashes their *Duke* levels.

Washington, D.C. is the battlefield this time. Working either with your registered *Duke 3D* or *Duke Atomic*, each of the nine new levels are modeled after various real-world D.C. sights, including the White House and the Lincoln Memorial.

While there are no new weapons or enemies, the levels are for the most part pretty accurate representations of the real thing—and more *Duke* is more of a good thing.

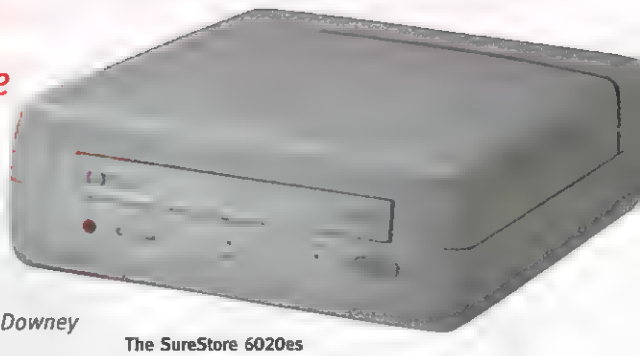
Price ***$25***
Developer ***WizardWorks***
Publisher ***WizardWorks***
Phone ***800.229.2714***
URL ***www.wizworks.com***

boot verdict 6

CD-Recorders Spin Up

Speed readers with carpal tunnel syndrome

Picture spinning Kerri Strug around as fast as you can by her tiny ankles (be careful of the left one). Now give her a can of spray paint and see if you make a complete circle. This would be a CD-ROM drive. Now try the same thing with Shelley Winters and you'll have an idea of the difficulties faced with CD-R drive acceleration. Historically, CD-R drives haven't matched the pace set by their 16x CD-ROM cousins because of the added mass of a write-capable head bogging down the works. These three 2xWrite/6xRead CD-R drives take baby steps in the right direction. — Sean Downey



The SureStore 6020es doesn't believe in advanced features.

Hewlett-Packard **SureStore 6020es**

The 6020es addresses all the shortcomings of the extremely popular 4020i. It comes in three varieties: SCSI internal, parallel external, and SCSI external, giving buyers more alternatives than the original internal-only drive. It also bundles full versions of EZ-CD Pro and Alchemy, rather than the much-criticized lite versions that came with the 4020i. Another shortcoming of the 4020i, the crappy Advansys SCSI adapter, has been addressed by bundling the 6020es without a SCSI adapter at all.

Unfortunately, that's as far as HP went.

Beyond accelerating the read speed, the Philips-equipped 6020es pushes no new boundaries. The drive knocks off fine scores in our CD-R mastering tests, and serves up a competent solution to the casual CD-R user. It supports all the formats a CD-R should: CD-ROM, CD-ROM XA, CD-Plus, CD-I, and CD-DA; all but packet writing. This means that new software packages offering a more stable mastering process and drive letter access (such as DirectCD, see page below) will not work with the 6020es drive.

During testing the 6020es had problems recognizing blank Kodak and Sony discs. These two popular brands of media are used exclusively for all our CD-R benchmarking, so we were forced to test with HP's own media. Beyond an order form for HP's blank discs there's no mention in the documentation of what type of media is recommended for this drive.

There is no forward-thinking innovation in the 6020es, just backward-looking ass covering. This begs the question, "What do you do when you want more power?" Buy another drive, of course.

Price ***$943***
Company ***Hewlett-Packard***
Phone ***800.810.0134***
URL ***www.hp.com***

Philips **CDD 2600**

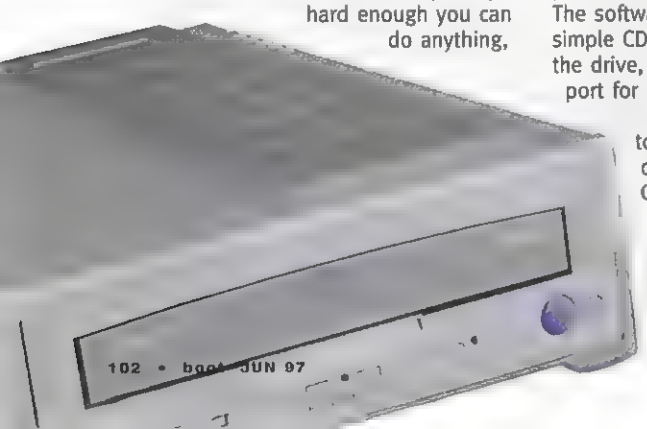
This is the burner of choice in the bootLab. It's based on Philip's own drive mechanism and comes stock with a 1MB buffer. The CDD 2600 is recognized by every major CD mastering package on the market. It supports packet writing and speaks all the CD-R dialects: CD-ROM, CD-ROM XA, CD-Plus, CD-i, and CD-DA. The latest firmware revision also supports variable packet writing and will work with DirectCD.

It's nearly impossible to burn a bad disc with this drive. Of course, if you try hard enough you can do anything, and the bundled CD Creator 2.0 makes failure a distinct possibility by routinely bypassing the ASPI layer and sluggishly plodding through every task put before it. The software's easy to use and performs simple CD-R tasks but doesn't complement the drive, with features such as full support for long filenames.

Seagate Backup Exec promises to be impressive, and by the looks of the beta version we received, CD-R's potential as a backup device has finally been realized. The software's packet writing technology treats your CD-R the same as a tape backup drive, only it's faster and more permanent. As of this writing, discs burned with the software can only be recognized by Seagate Backup. Hopefully this will change by the time the full product is released.

Price ***$699***
Company ***Phillips***
Phone ***800.235.7373***
URL ***www.phillips.com***

	CDD 2600	6020es
Package	Adaptec 1535A SCSI adapter; two blank discs; Seagate Backup Exec for CD-R; Adaptec EZ-SCSI 4 and CD Creator 2.0	One blank disk; Adaptec Easy-CD Pro 95; IMR Alchemy Personal
On-the-fly torture test (mins)	18	28
Create 390MB ISO image file (mins)	13	12
Burn 390MB ISO image file (mins)	25	13
Packet Writing* (mins)	20	Not supported by drive
Wave to Red-Book audio	Yes	Yes



There aren't enough o's in smooth to describe the lines on Philips' CDD 2600 drive.

TigerShark

Smoke underwater

The embodiment of *TigerShark*'s weak interface is a radar that doesn't indicate if the target is above or below the water.

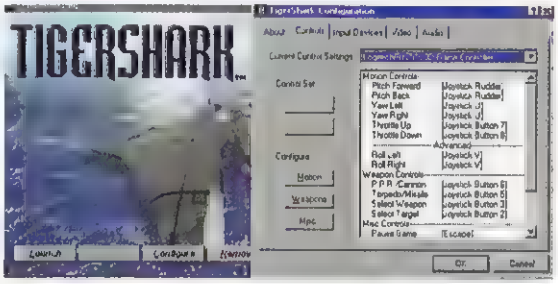
TigerShark—an ambitious pseudo-3D shoot 'em-up—is more remarkable for its poor execution than its gameplay.

The TigerShark, an experimental U.S. military craft, is a hydrofoil/submersible hybrid equipped with a variety of weapons. Gameplay is simple: scour the worlds above and below the South Pacific Ocean in the TigerShark, destroying just about everything in your path.

Alas, veteran gamers will find *TigerShark*'s action deadly dull.

Throughout the game you encounter a variety of rendered 3D- and 2D-sprite enemy ships, buildings, and weapons, along with the usual energy, ammunition, and shield power-ups. With only nine missions and four skill levels, there just isn't much to the game. Control is quick and responsive—a joystick with built-in throttle control is recommended for reverse-thrust maneuvers—and the physical dynamics of the ship (including maximum speed and turn rate) are noticeably different, depending whether you're traversing the deep blue seas or hovering in the air. *TigerShark* even supports two game controllers not yet officially announced: Microsoft's Force Feedback joystick (slated for release late this fall) and Logitech's new 6-degree controller (available in late June).

That aside, *TigerShark* is rife with anomalies. The game is enhanced for both MMX and 3Dfx (filtered texture maps, fogging, translucency, and lighting effects), but support is independent. The difference is immediately apparent: at 640x480 resolution in 16-bit color, the MMX-enhanced version spits out a mere 15fps to 20fps, while the 3Dfx version dishes up a smooth 24fps to 30fps.



It's amazing what secrets are hidden within the configuration screens.

If only they served fish this big at Red Lobster restaurants!

TigerShark's graphics aren't too impressive and lack polish. Fogging effects are over-used and in many cases are used to hide clipping planes and texture seams that are glaringly obvious in the surface landscapes. And although the explosions and smoke are translucent, you can't see below the water while hovering on top.

Other peculiarities include underwater smoke effects (where are the bubbles?); 3D polygonal fish the size of submarines that lack collision detection and are impervious to attack; plus, the absurdity of your craft bouncing off the shores and underwater structures when you hit them. Sound effects are sparse and derivative, and the music score sounds suspiciously like it was lifted from a Cirque du Soleil performance.

Installation is just as quirky. *TigerShark* runs directly from the disc without installing files to the hard drive or a shortcut to the Start menu. And since each version (MMX, 3Dfx, non-enhanced) is contained in its own executable, you can only access the game configuration screens by shelling out to another window. What a pain. And there's no multiplayer support either.

TigerShark tries hard, but lacks bite.

— Bryan Del Rizzo

TigerShark's graphics aren't too impressive. Check out the straight fog line.

CHECKLIST

Maximum Resolution/Color 640x480/16-bit
Win95 Native
3D Hardware Acceleration 3Dfx
3D Sound DirectSound
DirectX DirectDraw DirectSound DirectPlay DirectInput
Specialty Controllers Force feedback

Price $43
Developer n-Space Inc.
Publisher GT Interactive
Phone 800.610.4847
URL www.gtinteractive.com

Subwoofer Showdown

Shake, rattle, 'n' roll

Since most two-way multimedia speakers suffer from extreme bass anemia, a subwoofer is a must. Even the heartiest desktop speakers bottom out around 150Hz to 200Hz—way above the sub-100Hz nether regions where you actually feel the sound. To really bring down the house, try adding one of these bass bangers to your mix.

— Andrew Sanchez

Cambridge SoundWorks **PSW1**

In the war for bass supremacy, Cambridge SoundWorks' PSW1 is an aural atomic bomb exploding in your eardrums.

A massive 12-inch low-throw subwoofer loaded in a sealed box provides the air-moving muscle. The PSW1 is unshielded, so place this box far away from anything that may be remotely offended by magnetic fields such as monitors, floppy disks, testicles, etc. The black vinyl-clad enclosure is *muy grande*, measuring 26.75x15.5x11 inches. The rear of the enclosure houses all the goodies, including a robust 140W, heat-sink-laden MOSFET amplifier. An 18dB per octave crossover provides steep low-pass filtering at 55Hz, 80Hz, 100Hz, and 140Hz. Gold-plated RCA inputs and banana plugs for speaker-level input interface with your existing system, and a rotary switch selects amplified or line-level input. And as if this single monstrous subwoofer isn't enough to make your ears bleed, a slave unit can be linked to the PSW1 for extreme foundation-shaking subwoofer salvation.

When the PSW1 powered up, the lights in the building dimmed and the bootLab exploded with gargantuan bass. With the added headroom of 140W, there's nothing the PSW1 can't handle. *Also sprach Zarathustra* violently shook anything that wasn't nailed down, while the system gracefully played frequencies down to an awe-inspiring 21Hz! Even as lower frequencies became inaudible to human ears, the woofer continued to move the air. The bass energy the PSW1 unleashes is nothing short of phenomenal. *Quake*'s ancient machinery straining to open a door, and the unearthly, pulsing hum from an awaiting slipgate sends shivers up your spine and shakes your innards. Overall performance is extremely accurate, reproducing low rumbles and tight kick-drum attacks with equal authority. The only problem is finding a pair of satellite speakers able to keep up with the PSW1.

The price to arm yourself with the best may be high, but the Cambridge SoundWorks PSW1 subwoofer is guaranteed to impress your friends and make new enemies. This is as close to bass perfection as you get.

The Cambridge SoundWorks PSW1 is the ultimate subwoofer experience.

Price ***$699***
Company ***Cambridge SoundWorks***
Phone ***800.367.4434***
URL ***www.hifi.com/ourstuff.html***

SAS **Bazooka M5**

Southern Audio Services launches some booming bass with their Bazooka M5 subwoofer enclosure. Having won their stripes in the car audio wars, SAS now brings their patented tubular enclosure to your home.

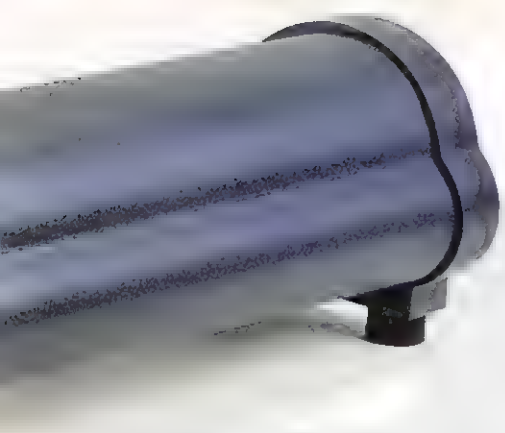
A massive 0.22-cubic-foot tubular enclosure houses a single 5-inch treated-paper cone driver. Despite the cylindrical enclosure, the system relies on the tried-and-true bass-reflex/ported design, tuned to a frequency of 39Hz. Thirty watts power the woofer. Betraying their roots, SAS has driven the amplifier down to 2ohms—a tactic usually seen in car audio. With impedance down, an amplifier can squeeze out more juice (usually twice the rated 4ohm output), but at the price of a hotter-running amplifier and possibly a sloppier bass output... unless the amp is engineered as a 2ohm amplifier from the start.

The Bazooka M5 comes with a mini remote control armed with a master volume control that also allows for separate subwoofer output control, and more importantly, a variable crossover control. Fully adjustable from 50Hz to 250Hz, this tailors your subwoofer sound to your acoustic tastes.

Performance with the Bazooka M5 varies greatly depending on enclosure placement and crossover setting, so expect to tweak long and hard before you rock the house. Listening to the sub both corner-loaded and free-standing, the system went through our low-frequency gauntlet with minimal fuss. We recommend corner-loading the Bazooka (i.e., pointing the subwoofer into a corner) for maximum efficiency. You'll lose anywhere from 3dB to 10dB if it's not properly loaded.

Frequencies as low as 35Hz are audible before fading into the background. *Also sprach Zarathustra* produced the faint audible subfrequencies inherent to the piece, but not enough to shake the room. To its credit, the Bazooka M5 didn't bottom out and distort when pushed to the max. Overall bass response is smooth, controlled, and punchy, lacking only in the ultra-low frequencies.

The SAS Bazooka M5 is pricey and takes up a fair amount of floor space, but



Bomb that bass with SAS's latest subwoofer, the Bazooka M5. Just watch where you point that thing!

once you get this thing loaded and primed, you'll be bumpin' in no time.

Price *$249*
Developer *Southern Audio Services*
Phone *800.849.8823*
URL *www.sasbazooka.com*

boot verdict 8

Subwoofer Tests

If the sadist in you feels like whipping your subwoofer to the edge of pain and beyond, strap on these tests (we do all the time).

Also sprach Zarathustra* from Telarc's *Time Warp
Track 2 contains some of the strongest and deepest bass ever captured on a CD. The low-frequency rumble that starts this track ends in a massive crescendo of hardcore bass and instrumentations.

"Speak To Me" from Pink Floyd's *Dark Side of the Moon*
The ultra-low frequency heartbeat that dominates the first minute of this track will make your subwoofer bleed.

Test CD #101 from Autosound 2000
This bad boy turns your CD into a bass-frequency generator. Tracks 10 through 98 are sine waves corresponding to the track numbers. (Great for simulating earthquakes and shaking china from the shelf.)

***Quake* by id software**
Listen to the rocket explosions and creaking opening gates for some subterranean rumble. The shotguns and nail guns test the responsiveness of a subwoofer.

Yamaha **YST-MSW10**

Yamaha's tough, burly YST-MSW10 subwoofer handles low frequencies like a champ—just don't expect any earth-shattering boom.

The workhorse of Yamaha's multimedia subwoofer family, the YST-MSW10, is no slouch when it comes to producing low-frequency harmonics.

Made from treated particle board, a cool 25W powers the 6.5-inch spruce-paper woofer. Yamaha opted for the standard bass-reflex enclosure tuned to 46Hz. The woofer employs an active-servo system, which allows the amplifier to monitor cone movement via sensors connected to the woofer. If movement exceeds a pre-set limit, the amp either eases up on output, or actually sends a signal that brings the woofer back under control. The plus is that you can never overdrive your woofer (the leading cause of distortion) and destroy your boom box... in theory. The minus is that the added weight of the sensors always lowers the speaker's efficiency, requiring a bigger amplifier to push the heavier cone. In practice, the woofer eased up, never forcing the driver to over-exert itself when force-fed, low-frequency tones.

In addition to the power switch and sub-volume control, a crossover button switches between two low-pass filters. Using the lower 100Hz crossover point produces better bass overall, while the higher 200Hz setting muddies and reduces the woofer's punch. The sub's power switch automatically switches off the box when no signal is sensed, which is problematic because low-volume listening fools the woofer into shutting down inappropriately.

Overall, the system kicks solid bass down to the 35Hz to 40Hz range with an emphasis on solid 50Hz to 80Hz reproductions in our music and game tests, where the woofer exhibits excellent control across the frequency spectrum.

Price *$149*
Company *Yamaha*
Phone *800.823.6414*
URL *www.yamaha.com*

boot verdict 7

Labtec **LCS-2408** Universal Subwoofer

If you really get off on substandard bass, the LCS-2408 Universal Subwoofer will have you pitching a tent.

A 5.25-inch, treated-paper long-throw woofer mounted in a ported plastic enclosure is Labtec's answer to universal bass harmony. The internal amplifier dribbles 14W of bass frequencies up to the non-adjustable 150Hz crossover point. Two ill-placed knobs above the port control overall system volume—not the best place to put variable controls that are bound to be tweaked time and time again.

Also, this woofer has the largest power brick we've seen short of an industrial-grade laser.

The LCS-2408 choked on all the bass-intensive sessions thrown at it—flailing uncontrollably during our low-frequency tests. *Quake* failed to impress, and the colon-blowing might of *Also sprach Zarathustra*'s rich, low frequencies was reduced to a trickle. In addition to its other sins, the LCS-2408 also suffers from excessive enclosure resonation. Low-volume listening is decent enough—just don't crank the volume.

Frankly, this subwoofer's about as sexy as a prostate examination.

A master volume knob's a terrible thing to waste... and the Labtec LCS-2408's is located on the floor!

Price *$70*
Developer *Labtec*
Phone *360.896.2000*
URL *www.labtec.com*

boot verdict 2

Fragile Allegiance

Do not stamp, spindle, or mutilate

TRY IT ON THE DISC

Few games mix resource management, diplomacy, and interstellar combat with the same success as *Master of Orion*. Interplay's *Fragile Allegiance* follows quietly in its predecessor's footsteps.

Gameplay involves mining an asteroid for a megacorporation, sending scouts in search of other asteroids to mine, setting funding levels, gathering fleets to battle aliens, dispatching spies, and so on, all in real time. *Fragile Allegiance*'s rendered 640x480 SVGA graphics uses small-screen 3D motion-captured animations when you're conversing with agents, contractors, and alien species. However, the interface makes frequent use of buttons with (mostly cryptic) icons. Thankfully, *Fragile Allegiance* comes with a wealth of animated online tutorials and a halfway decent print manual.

Resource management and critical timing are key factors for winning in *Fragile Allegiance*. The AI is particularly good; double-cross an alien and he'll screw you over in the months that follow. If you tire of the 11 preset scenarios and the custom game, there's always eight-player IPX network play.

Fragile Allegiance is no *Master of Orion*, but it's still damn fun.

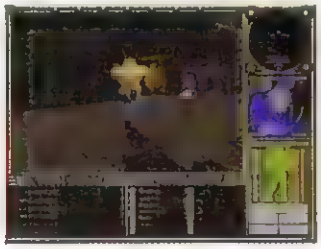
— *Alan Dunkin*

Price $50
Developer Gremlin
Publisher Interplay
Phone 714.553.6678
URL www.interplay.com

boot verdict 8

Scarab

Egyptian conniption



TRY IT ON THE DISC

Scarab is a novel approach to your typical first-person shooter, combining elements of strategy, combat skill, and resource management in a complex package that's difficult to master. Imagine walking around inside an oversized pinball machine decorated with neo-futuristic Egyptian contraptions and you have the idea.

It's your small army against their small army. You can either blow them away one by one or strategically beat them by successfully milking the area for power. Sounds like the blueprint for modern-day imperialism.

Aside from quirky joystick controls, both the full-screen DirectX and regular Windows versions are well executed. The realistic behavior of your computer-controlled opponents makes you wonder if you've accidentally connected to a network game. Six-combatant Internet mode is a hoot and *Scarab* also supports two-player modem connections.

Scarab is an interesting mix of first-person action and squad-level strategy, with less-than-stunning graphics and gameplay that's a turn-off for the twitch-minded. If you want another easy-to-play *Doom* clone, stay away, but if you have plenty of patience and several free hours, *Scarab* could be the game for you.

— *Bart Lane*

Price $50
Developer Electronic Arts
Publisher Electronic Arts
Phone 415.571.7171
URL www.ea.com

boot verdict 6

NCAA Final Four 97

The play's the thing

TRY IT ON THE DISC

Collegiate hoop must be judged differently from the pro game.

In games such as *NCAA Final Four 97* you aren't dealing with name players bolting from franchise to franchise. In the NCAA, the game is less about the players than about the schools. The program is what makes the game; and without star names, the game is what makes the program when it comes to college b-ball sims.

As a game, Mindscape's rookie foray into the sports arena is a pull-up J. With 64 Division 1 teams to choose from and the option of hooking up as many as four players with Gravis game pads (no network/online play), there's plenty to tempt here.

But the play's the thing, and *Final Four*'s play is pretty good.

It's sufficiently challenging to get inside for the slam, and when you do you're rewarded with one of the game's more than 35 motion-captured dunks. Still, most of the shots you'll see from the game's many (10+) camera angles are pull-up jumpers from 12 to 15 feet out. Airtight D is tough to maintain with the slippery collision detection that always seems to kick in when you're charging the hole.

Final Four and the stick figure, low polygon-count players that traipse up and down its 640x480, 256-color courts is second only to *NBA Live 97* in graphics and overall play.

— *Brad Dosland*

Price $40
Developer High Voltage Software
Publisher Mindscape
Phone 800.234.3088
URL www.mindscape games.com

boot verdict 8

A **Fork** in the **Tale**

Making the best of a sorry lot

You'll have to kick this scallywag in the nards to get through *A Fork in the Tale*, and you'll also need a mighty tolerance to the inherent evil of FMV.

TRY IT ON THE BOOT DISC

In the sneak preview issue of *boot* that you never saw—unless you attended last year's E3 trade show—AnyRiver Entertainment CEO (and co-founder of Electronic Arts) Stewart Bonn confessed that he had never seen an FMV title that works. He summed up the history of the genre saying: "The technology stank and the acting was bad."

Well, the technology has improved.

A Fork in the Tale is a five-disc FMV extravaganza featuring the voice of Rob Schneider (best known as the copy-room guy on *Saturday Night Live*) that has you scrambling for your miserable life in a medieval realm. The action (if it can be called that) takes place in a 640x480 screen in 256 colors and primarily involves clicking on the blinking hot spots which randomly appear overlaying the video.

The game's big breakthrough lies in the Immersion Engine, a proprietary engine developed by Advance Reality, which nearly eliminates the load times that have made prior FMV attempts stop-and-go affairs.

This, along with the hours of compressed broadcast-quality video shoehorned onto the five discs, gives the story a reasonably broad, branching scope. But still... you run down the same hall again and again. In *Fork*'s first segment, every time you're "killed" you end up swimming back to shore. The "interactivity" involves guessing which three-step combination of left or right turns leads to shore. Boring.

The game's acting is better than the amateur variety found on so many discs, and some of Schneider's purported 5,000 wisecracks are genuinely funny. But overall, performances fall significantly short of soap-opera caliber.

The bottom line: FMV may just never work, but *A Fork in the Tale* is an excellent effort. Professional production values and seamless technology are not critically undercut by the acting. The problem is that FMV is an inherently weak model for interactivity. Given the incredibly fluid and dynamic hand-to-hand combat of *VirtuaFighter* or *Quake*, *Fork*'s action is embarrassingly retro.

Still, *A Fork in the Tale* may hold some novelty value as possibly the best (and hopefully the last) FMV game. But that's sort of like winning best actor at the porn industry's equivalent of the Academy Awards.

— Brad Dosland

CHECKLIST

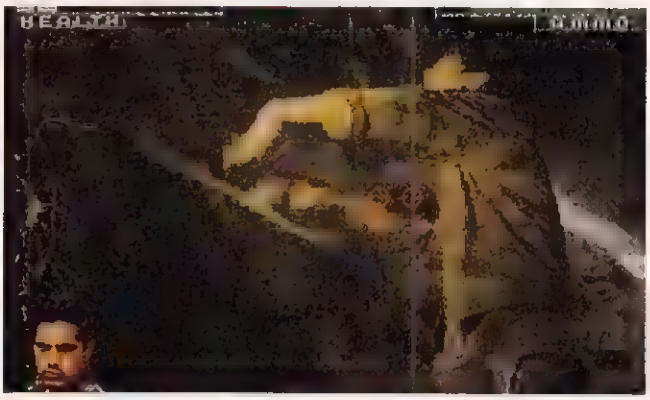
Maximum Resolution/Color
640x480/8-bit
Win95 Native
DirectX
DirectDraw DirectSound

Price ***$50***
Developer ***AnyRiver Entertainment***
Publisher ***Electronic Arts***
Phone ***800.245.4525***
URL ***www.anyriver.com***

boot verdict 6

Soldier **Boyz**

Boyz in the platoon



Soldier Boyz **brings bad acting and a lame B-movie plot line to a PC near you.**

Playing *Soldier Boyz* is like watching the same movie trailer again and again—only it's not as satisfying.

In between passively watching FMV clips, you spend what seems like hours trolling the screen in first-person perspective searching for enemy Vietnamese guerrillas. As they pop up, you send them to FMV hell with a click of the mouse. Eat too many of charlie's slugs and you're forced back to the beginning—after the obligatory taunting by the main villain.

Of course, the inherent weakness of FMV is that you must follow the given storyline because it's all that's been filmed. Progress is only made by repeating the same scene until the correct series of mouse clicks is found.

In keeping with FMV's tradition of insipid dialogue, awful acting, and pitiful cinematics, *Soldier Boyz* features international action stars Cary-Hyroyuki Tagawa (of *Mortal Kombat* fame) as an evil-Vietnamese-guerrilla-now-evil-Vietnamese-terrorist and Michael Dudikoff (of *American Ninja* infamy) as the retired-green-beret-now-prison-warden posturing as steroid-crazed WWF gorillas. Hired to rescue a wealthy businessman's daughter, Dudikoff takes the toughest hoodlums from his maximum-security juvenile hall into harm's way. The young convicts proceed to mow down everything that rears its head.

If this vapid plot seems insulting, that's because it is. And you can't use the excuse that it's "only a game." *Soldier Boyz*'s footage was shot in conjunction with an HBO feature film of the same name. Finally, Hollywood doesn't have to do that silly marketing shuffle of basing computer games on movies, or movies on computer games. Now they're woven together into a point-and-click rail shooter that allows you to relive the gratuitous violence and cornball one-liners of the film again and again and again.

Soldier Boyz makes it seem as if we could have won the war in Vietnam if we had only sent gang members over there.

— Sean Downey

CHECKLIST

Maximum Resolution/Color
640x480/8-bit
MS-DOS

Price ***$22***
Developer ***Hypnotics Inc.***
Publisher ***DreamCatcher***
Phone ***888.611.9999***
URL ***www.dreamcatcher.com***

boot verdict 3

boot radar

PRODUCT ANNOUNCEMENTS: THEY **TELL** US, WE **PASS** IT ALONG

MANLY, YES. BUT I LIKE IT LIKE THAT

The **Laptop Dry Suit** is a rugged case for portable computer users who subject their notebooks to harsh conditions. Attractively styled for formal settings, but rugged and lightweight for those occasions when you leave the civilized world, the Laptop Dry Suit protects your notebook against abrasion, extreme elements, continuous submersion—even severe G-shock.

Made from nitrogen-blown neoprene and finished in high-density fabric, the Dry Suit is priced at $349 and accommodates most notebooks with room for additional gear such as a cellular phone, external hard drive, and solar battery panel. External strap loops allow attachment to gear bags and backpacks.

Plunge Inc.: 800.678.9011

I SPY WITH MY CATSEYE

Sony's new **DKC-5000 CatsEye** digital camera produces high-resolution images with remarkable color fidelity at a remarkable price of $16,950.

The CatsEye camera performs real-time, full-color image capture and transfers images to a computer in 10 to 20 seconds. The camera uses three 440,000 pixel, half-inch CCD chips (for a total of 1.3 million pixels) to capture RGB color information separately and simultaneously for accurate color interpretation. Additionally, the CatsEye system's color accuracy and high resolution are achieved by a unique spatial pixel-offset feature where the blue and red images are mounted in complete alignment on an optical block, allowing light to strike corresponding pixels on the red and blue sensors. This allows the camera to capture the full range of 256 color gradations to yield images with strikingly wide color and tonal range. Other notable features include 10-bit analog-to-digital conversion for wide dynamic range; a signal-to-noise ratio of more than 56dB; controllable gamma, knee, and white clip; and a direct-print function that allows users to print to a Sony digital color printer without using a computer.

The system also comes standard with a remote control, camera cable, SCSI cable, A/C power cord, and a half-inch bayonet lens mount.

Sony Electronics: 800.635.7669; www.sel.sony.com

BEAM DOWN BAYWATCH

Adaptec, working in conjunction with DIRECTV and Microsoft, announced **ABA-1010**, a PC satellite receiver card that will let you download web sites and data via an orbiting satellite without the delays associated with modem-based connections.

Selected programs, web sites, business information, digital movies, and other services are delivered to your PC (at speeds up to 30Mbits/sec) via Adaptec's ABA-1010 receiver card and then automatically cached to your PC's hard disk. The ABA-1010 also includes a smart card (which can be mounted on the front or rear of the PC) to provide subscriber access to a variety of services, pay-per-view shows, sporting events, and software programs. The receiver card uses a standard coax cable to connect to the 18-inch satellite dish, eliminating the need for additional set-top hardware. Adaptec wouldn't disclose which companies will bundle the ABA-1010, but did disclose that the service will cost $20 to $30 per month, which will include ISP access. Hardware is expected to cost about $400.

Adaptec: 800.442.7274; www.adaptec.com

RAIDERS OF THE LOST THEME PARK

GameWorks, a 30,000 square-foot entertainment facility combining cutting-edge technologies with a theme park mentality, has opened its doors in Seattle, Wash. Additional locations in Orange County, Calif. and Las Vegas, Nev. will open during the next few months.

Inspired by DreamWorks, Universal Studios, Sega, and Steven Spielberg himself, each GameWorks location will offer games ranging from the traditional (Pac Man, Pong, foosball) to the advanced (Vertical Reality). In this game four players are strapped into seats which can climb to heights of 24 feet. If you're successful at racing the clock and shooting the bad guys, you ascend; move too slow and you'll get hit and never make it off the ground.

GameWorks Seattle: 206.521.0952; www.gameworks.com

DIGITAL VIDEO ART

Ulead Systems has released **MediaStation Pro 5.0**, the fifth generation of their nonlinear video editing solution for Windows NT and Win95. New features include: smart rendering and previewing techniques incorporating support for MMX, Active Movie, DirectDraw, and Direct3D; additional support for MPEG and Truevision DVR formats; video color calibration using waveform monitor and vectorscope tools; and advanced sub-pixel rendering that ensures smooth motion and flexible keyframe controls.

MediaStation Pro 5.0 also incorporates five new integrated video-specific modules including: Video Editor, featuring more than 109 transitions, 50 video filters, rolling credits, ripple editing, and blue-screen effects; CG Infinity, which includes vector-based text and objects with full-line, fill, and transparency attributes, envelope distortion, and a library of premade graphic objects; and Video Paint, complete with retouching tools, cloning effects, and pressure-sensitive tablet support.

MediaStation Pro 5.0 retails for $595; an upgrade is $149.

Ulead Systems: 800.858.5323; www.ulead.com

ONLINE PROTECTION

Watch your back and stay safe from online evil with Coriolis' new book, **Web Psychos, Stalkers, and Pranksters: How to Protect Yourself in Cyberspace.**

The book retails for $24.99 and provides step-by-step instructions about protecting sensitive, personal information in e-mail communications, public bulletin boards, chat rooms, and web pages; shows you how to track down people who are harassing, abusing, or attempting to defraud you; and exposes the methods and techniques by which stalkers, con artists, and pranksters create hazards and cause problems for online users.

Coriolis Group Books: 800.332.7450; www.coriolis.com

TRY NOT. DO. OR DO NOT. THERE IS NO TRY

The struggle between good and evil continues in **Yoda Stories**, LucasArts' latest installment in their quick-play Desktop Adventures series. Set during the time spanning the The Empire Strikes Back and Return of the Jedi, Yoda Stories chronicles Luke Skywalker's adventures while Yoda is training him to be a Jedi Knight.

The game is a collection of short quests in which you encounter a variety of Star Wars characters in several familiar environments. To complete a game, you must explore each world, interact with other characters; and collect artifacts, tools, and assorted weapons, and engage in combat with Imperial Stormtroopers, bounty hunters, and nasty aliens, using either your lightsaber or the Force to immobilize your opponents. The game incorporates unique world-generator technology capable of creating countless short-game scenarios each designed to be completed in about an hour.

The $29.95 Yoda Stories package includes "Making Magic: A Behind-the-Scenes Look at the Making of the Star Wars Trilogy Special Edition Movies."

LucasArts: 800.985.8227; www.lucasarts.com

FAST AND FILTER FREE

The original Matrox Millennium was legendary as the 2D accelerator of choice in high-end systems. Now Matrox is hoping to relive that glory with the **Millennium Pro**. Sporting up to 16MB of lightning fast dual-ported WDRAM and a 250MHz RAMDAC, the Millennium Pro should really rock in high-resolution true-color modes. The Pro also sports all of the Matrox Mystique's 3D power—and its limitations: no bilinear filtering or fogging. But if high-end 2D or OpenGL drafting is your game, this may be the screamer for you. The Millennium Pro with 4MB is $299, and $399 with 8MB.

Matrox Graphics: 514.969.6320; www.matrox.com/mga

BIGGER IS BETTER

Virtual desktops be gone! Intergraph has announced the availability of the first high-resolution 28-inch multisync monitor, the **InterView 28hd96**.

With a flicker-free, 75Hz refresh rate supported at a display resolution of 1920x1080, the wide format InterView 28hd96 increases viewing real estate by almost 50 percent over current 21-inch monitor technology, making it an excellent choice for electronic design, desktop publishing, animation and virtual reality applications. Additionally, the monitor's aspect ratio of 16:9 is equivalent to the HDTV letterbox panoramic viewing specification.

The InterView 28hd96 is available for $9,995.

Intergraph Computer Systems: 800.763.0242; www.intergraph.com

To have your products listed in Radar, send product information to: radar@bootnet.com

SHOCKING boot EXPOSE

WHERE DOES CLIP ART COME FROM?

The Answer Can Be Found on the Trail of Arthritic Wrists

With a sallow face and a beaten spirit, the little girl struggles to find comfort in a cold metal chair. Her mangled hand, ravaged long ago by carpal tunnel syndrome, slowly pushes a mouse across an unforgiving steel table top. As harsh fluorescent lights beat down from above, and as the din of industry clangs in the background, the little girl's movements are echoed by some 120 other children in the cold, dank warehouse.

The shop foreman, deep into his rounds, stops behind the waif. "Rapidement!," he barks. "Maintenant!" Fearing unknown reprisals, the little girl rushes through the last strokes of a portrait of British Prime Minister John Major. It doesn't look like John Major. She knows it, and the foreman knows it. But it will do. It will do.

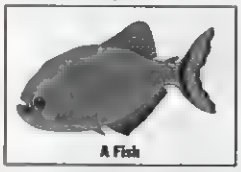
* * *

Bad lighting. Poor back support. Nary a wrist pad in sight. Such are the conditions suffered by the children of Ottawa, Ontario. Few people know it, but child laborers in Ottawa sweatshops produce an estimated 65 percent of the world's clip-art reserves. The remaining 35 percent is produced along a tortured trail of arthritic wrists ranging from Ireland to Iraq.

Generic bottles of steak sauce, anthropomorphic computer monitors with silly faces, snowmen with funny hats. All such clip art was originally rendered by innocent children working under the threat of the lash.

The World Health Organization recently reported that in 1996 nearly 20,000 children aged 12 and younger were indentured to global clip-art concerns. Some were sold into servitude by their impoverished parents, others were tempted by the seemingly genuine offer "Would you like to play with crayons?" and still others simply answered misleading correspondence art school ads in the backs of comic books.

Experts say the growing popularity of the World Wide Web has spurred consumer demand for voluminous libraries of unlicensed drag-and-drop images. It is a numbers game, and only the largest libraries will win. First came *40,000 Pieces of Bad Clip Art*, which was quickly followed by *Rank-Ass Clip Art 100,000*, and *200,000 Pieces of Crap*. Larger libraries inevitably loom on the horizon. The United Way and the Save the Children Foundation are monitoring a situation in Iraq, in which Saddam Hussein is building an underground facility that is expected to produce the mother of all bad clip-art collections, *1,000,000 Drawings of Duckies and Bunny Rabbits*, a follow-up to the poorly received *100,001 Drawings of the Elite Republican Guard*.



A Fish

Mavis Blatt, a United Way spokeswoman, says fighting the sweatshops with direct legal recourse is a loser's game: the illegal image mills float from location to location and are supported by an entrenched network of graft and secrecy. Blatt says clip-art syndicates can only be broken by cutting off their demand.

"Digital artists must wean themselves from the toxic allure of prefab imagery," she says. "They must just say no to cartoonish renditions of the Eiffel Tower. Say no to vague pictographs that attempt to discourage workplace romance. Resist the temptation to print and post around their cubicles funny industrial warning signs that say things like 'Safety Glasses Must Be Worn In This Area,' and 'Remove Hands From Machinery When Warning Bell Sounds.' They must pick up their drawing tablets and compose their own original art, lest the children of the world remain shackled to the cruel pillory of broken dreams."

The Trail of Arthritic Wrists

From Ottawa, Canada, to Baghdad, Iraq, more than 20,000 children are toiling in illegal clip-art factories. Help put an end to rampant carpal tunnel syndrome in adolescents—stop using clip art today.

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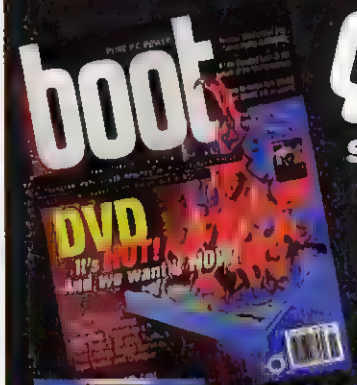

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Mystery Word Grid

	H				
		E			
P	I	N	C	H	W
	R				
S					

MYSTERY WORD

WORD LIST and LETTER CODE chart

PINCH .....W	PRESS.....K	BLAST .....A	WRECK .....D
BREAK .....Z	PUNCH .....S	SPRAY C	TURBO.....V
STOMP .....T	STAND.....R	PRESS .....E	DREAM ....O
CRUSH.....I	SCORE .....H	SLANT L	CHASE.....P

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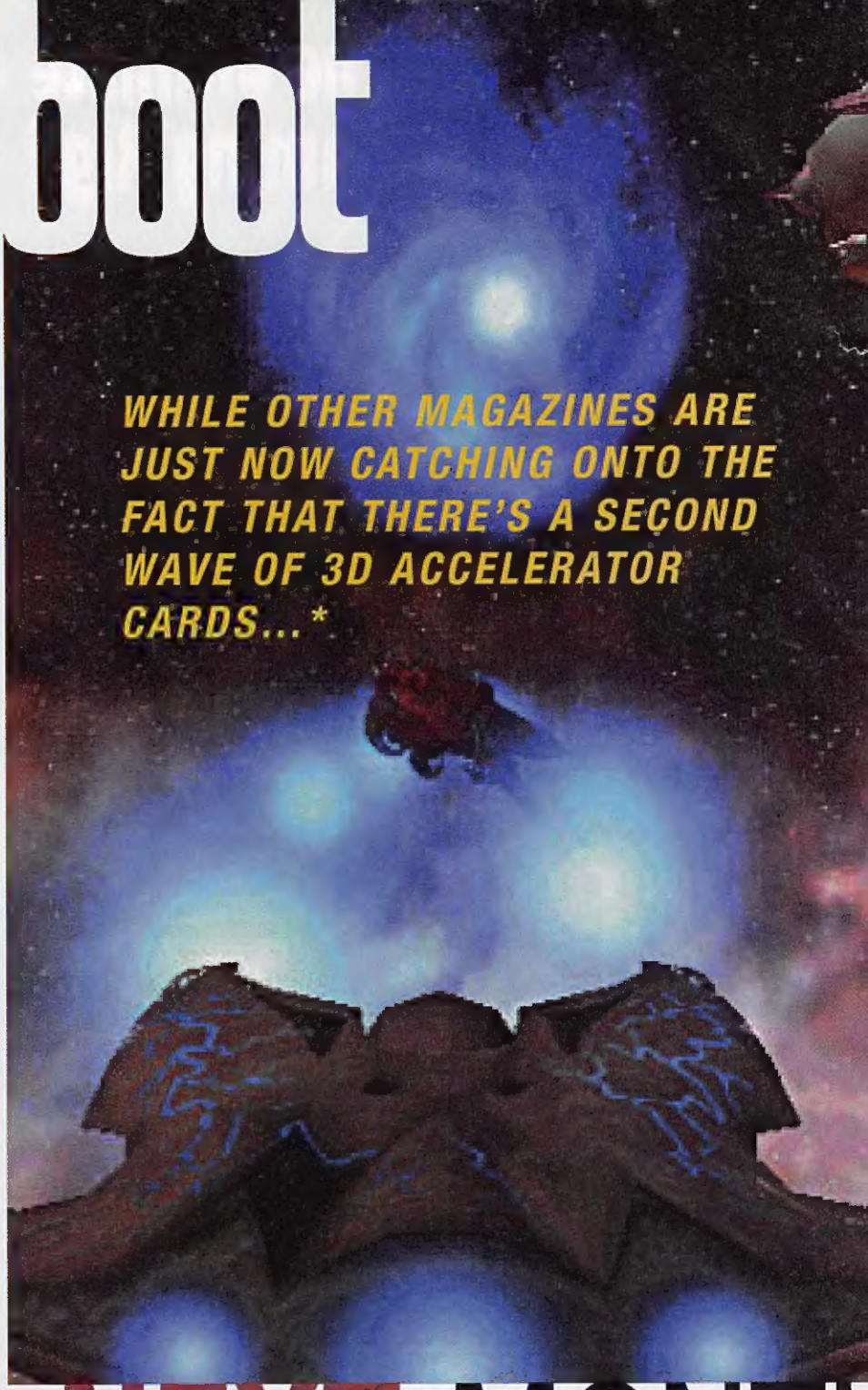

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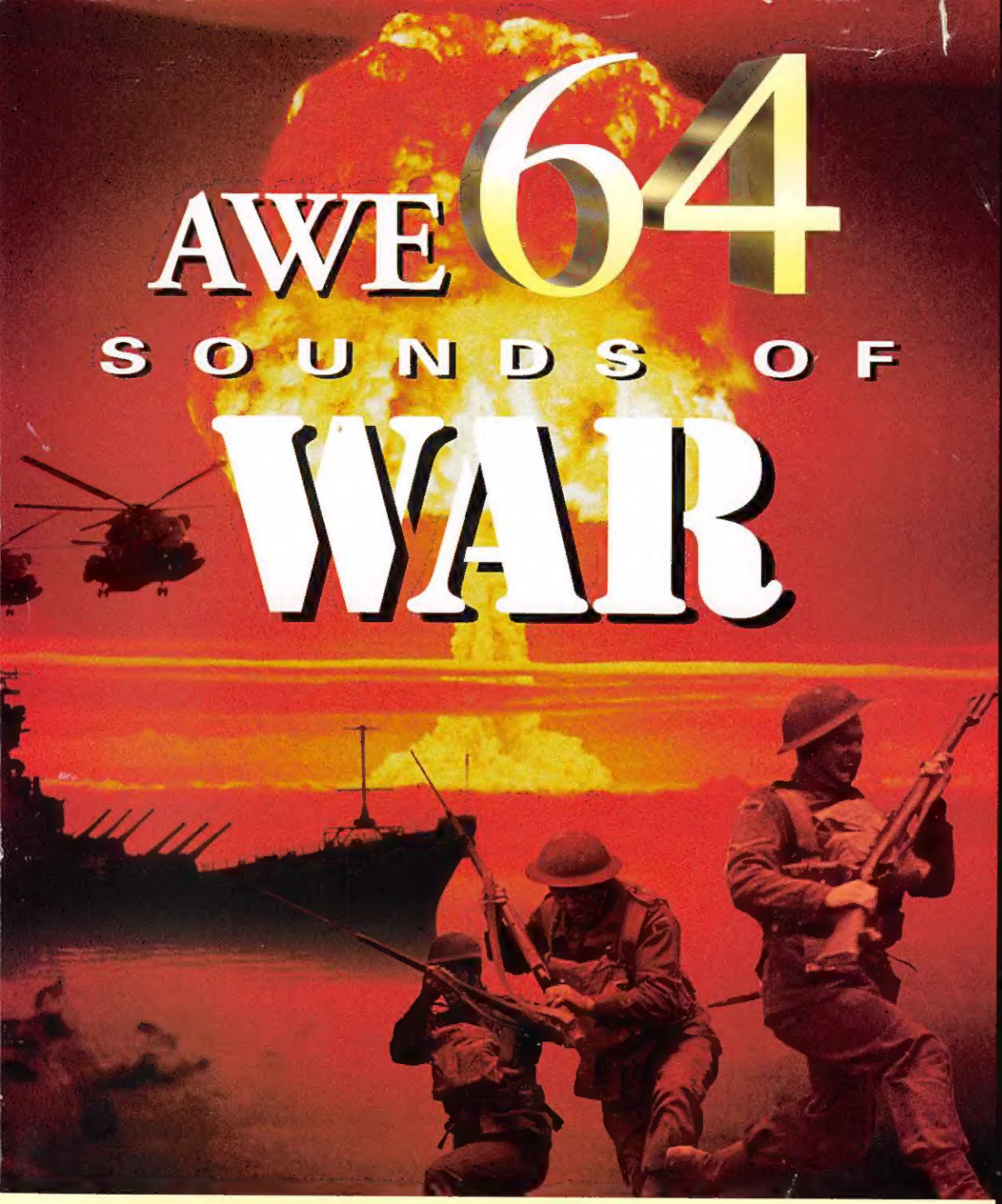

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